March 1973

# Smithsonian

A black lechwe, an endangered antelope, speeds through Zambia's watery floodplain (p. 34)

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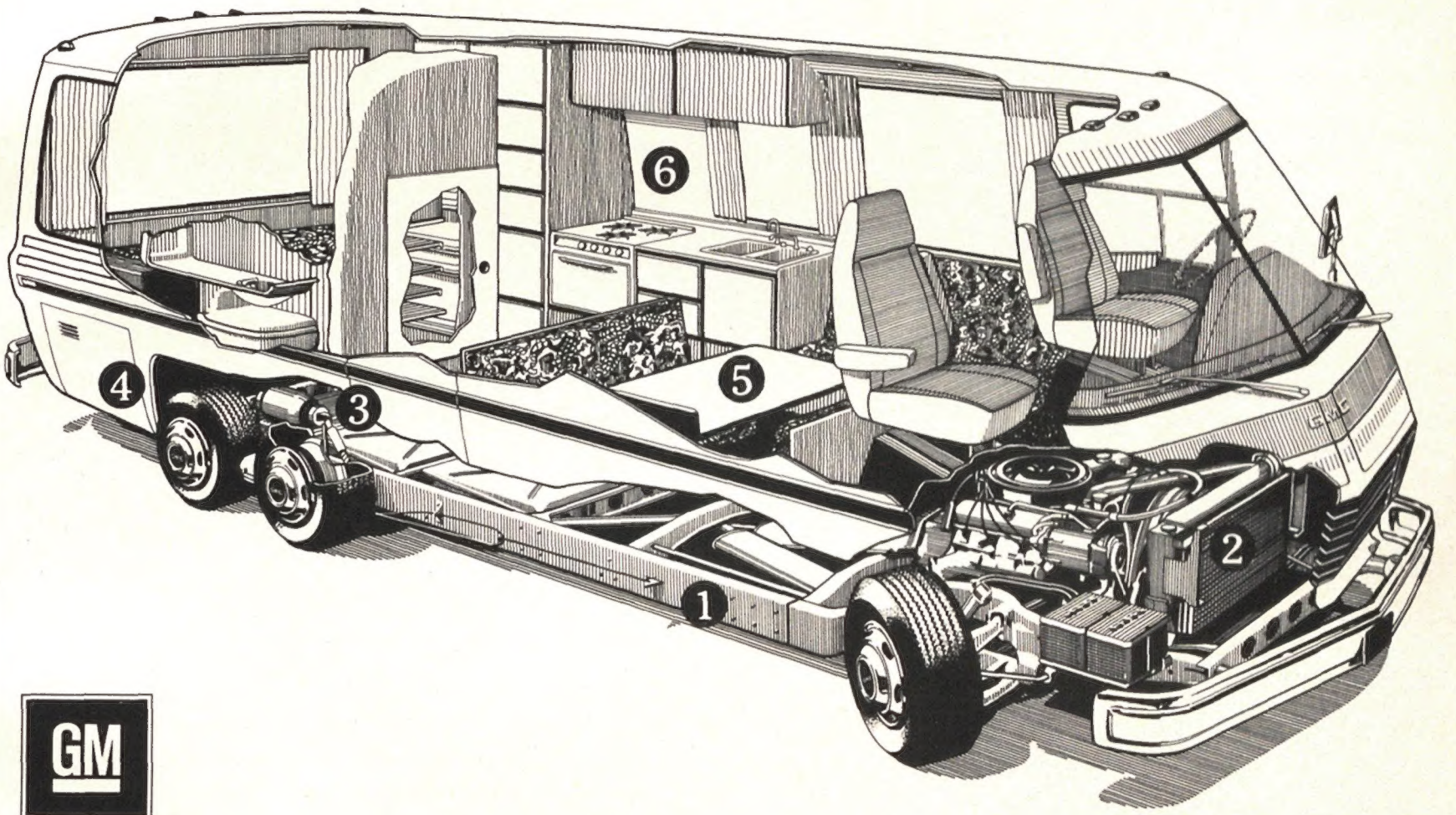


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# Smithsonian

Volume 3, Number 12

## *Table of Contents*

COVER: A black lechwe, one of Zambia's rare and endangered antelope, plunges through a water meadow in Central Africa's floodplain (p. 34)

6 The view from the castle: Secretary Ripley endorses, as a prototype, the idea of a supermuseum encompassing all of Greek culture from the earliest to contemporary

10 Phenomena, comment and notes: Advice for horn blowers, bandicoots and numbats in trouble, Yosemite's first auto, and progress in solar energy

18 Letters to the Editor

24 A pilgrimage through Copernicus' Poland on his 500th anniversary sheds light on this extraordinary genius who changed our ideas of the universe
By Donald Gould
Photographs by Erich Lessing

34 Amid the amazing bounty of Zambia's vast floodplain, a magnificent antelope, the black lechwe, and an ancient human life-style are both under the gun
Text and photographs by Richard Bell and Jeremy Grimsdell

42 Two West Virginia sisters find the good life in old-style farming and a thriving weaving business
By Peggy Thomson

51 A recollection of a girl's upbringing in the Kaiser's Germany and the elder and teacher who helped shape her life
Text and drawings by Hansel Mieth

56 The religious, "stupendous" passionflowers—plants that stirred missionary imaginations, assuaged pain, and even became a delicacy in the White House
By Edward S. Ayensu

62 The resplendent arms of Japan—restored by a craftsman—gleam anew in Smithsonian collections

64 Old circus wagons—the ornately hand-carved rolling stock that used to parade to the Big Top—still delight visitors to the museum in Baraboo, Wisconsin
By Armand B. Ferrara

72 Synthesizers, strange electronic devices, make the Now sound and may signify a revolution in music
By Philip Trupp
Drawings by Michael Griffin

78 Pursuing the king of the walnuts—that hard to find, outrageously expensive, impractical to cultivate black variety—and some tips on how you can grow them
By Hugh Moffett

84 Book reviews

92 March events at the Smithsonian

96 Then let them eat nightingales' tongues
By Patrick Ryan

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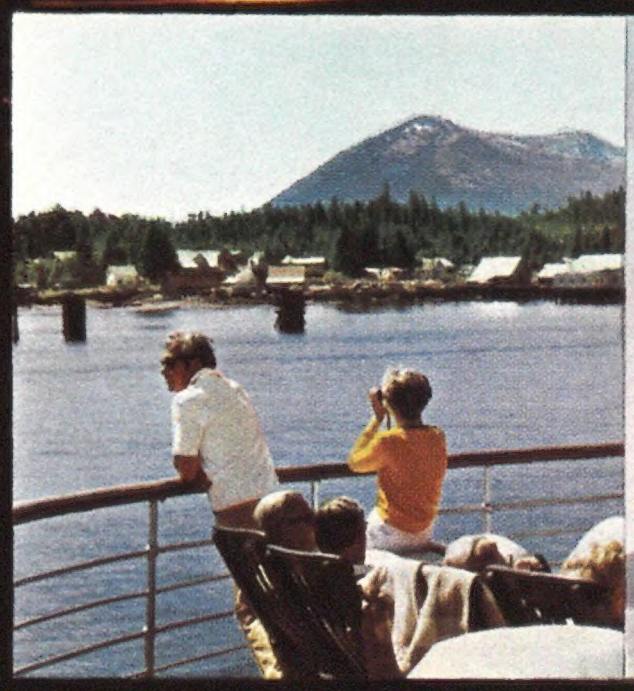

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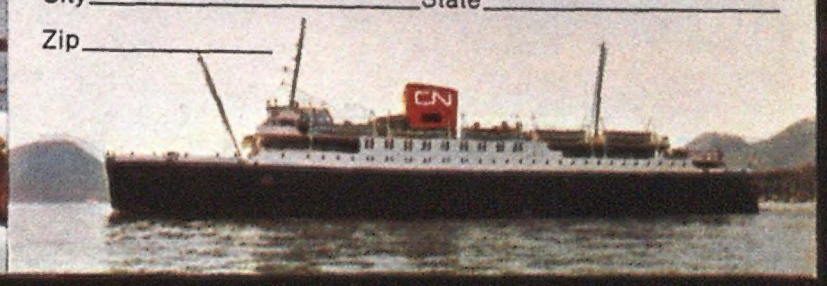

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*Secretary Ripley's comments*

# *The view from the castle*

*A supermuseum encompassing 3,500 years of Greek civilization would meet today's need for international cultural education*

In the hundred or more years since art museums started in the West to supply "the best facilities for practical instruction and for the cultivation of pure taste in all matters connected with the arts," we have seen the gradual loss of these innocent sentiments. Today art museums are run by boards of trustees not always motivated by philanthropy, a cause which all too often has disappeared in a welter of complex tax laws and a resulting infrastructure of tax lawyers, accountants and financial advisers. Egocentric collectors are still courted by museums for purely avaricious reasons. Social snobbery still persists through the acquisition and flaunting of *things,* promoted by dealers out to make a rich living for themselves.

Meanwhile, the urban poor are as uninterested as ever in the art fancies of the upper classes and their ethnic traditions. The middle-income groups, blue-collar or not, are more mobile today than most aristocrats ever were. Inexpensive tours from the West invade every nook and cranny of the world. The average citizen is now able to go and "see it like it is," wherever it still can be found.

But where is that? C. L. Sulzberger, of *The New York Times,* pointed out in a recent column that even in Greece, with all its magnificent collections of art and artifacts, "there has never been an adequate museum expressing under one roof the glory that has been Greece for over three thousand years." He thereupon proposed that Greece develop a supermuseum in one spot, encompassing every stage of its culture from the earliest to the contemporary—and with room to expand.

Constantinos Doxiadis, the international architect and planner, feels as I do that this idea makes so much sense that he is quoted as saying he would design such a conceptual scheme himself—presumably as a donation. Museums all over the world would be asked to contribute from the best of their Greek holdings (perhaps, with unprecedented generosity, keeping only copies for themselves). This would be a fine form of reverse lend-lease in these days of reevaluating museum collections. Lord Elgin's ghost could be laid to rest once and for all.

And so anyone would be able to go to Athens in a twinkling and see there, in a "whole earth" museum created on Greek soil, all the successive Greek cultures since prehistory, shown panoramically as in the great National Museum of Anthropology in Mexico City.

The worn stones from Minoan times, the cyclopean battlements, could guard streets of shops and traders thronged with warriors, artisans, athletes and hetaerae from Cretan through Mycenaean, Greek city-state, Hellenistic, Roman and Byzantine times. What an extraordinary experience for the tourist, flying in from anywhere, to be able to walk down a street with the entire history of Greece passing before his eyes.

When people move so freely, the whole concept of cultural education has to change, and be thought of in international cooperative terms. The old patterns have gone with the wind. Let museums and their trustees now help to show their wealth internationally, in the realization that the new cities are linked by the endless mobility of the very people they formerly thought to serve in their own backyards and public institutions.

S. Dillon Ripley

# Conversation Pieces

***Technically intriguing items from TRW, guaranteed to add luster to your conversation and amaze your friends.***

***Oh Say Can You See*** Discussions about whether or not we should "go into space" often overlook a fundamental point—namely, that we are in space already. Each of us is an astronaut on a spacecraft called earth traveling around the sun at 18,000 miles per hour. The biological community that lives on the spacecraft has a fragile life support system–the thin film of soil, air and water in which we dwell. During the past century, the number of passengers aboard the spacecraft has increased tremendously; so also has their ability to consume its finite supplies. We see some of the results in the pollution of our environment and the decay of our resources.

As astronauts we need to take care of our spacecraft—to check on its status, to monitor its resources, and to see that we are not doing irreparable damage to its vital life support system. With this in mind, NASA has undertaken several programs which will bring the technology of space to bear on some very down-to-earth problems. One of these programs involves the development of advanced sensors. From the vantage point of a satellite orbiting the earth, these sensors will someday be able to monitor air quality, determine the condition of crops, or help locate mineral resources.

Currently, TRW is developing such a sensor for NASA. It is called MOCS, an acronym for Multichannel Ocean Color Sensor. MOCS is based on the principal that each object on earth reflects light in a unique manner. The light reflected from oil, for example, is quite different from that reflected from water. Thus the two objects can be distinguished on the basis of their spectral response or "signature." MOCS senses the radiation reflected from objects in its field of view and diffracts this radiation (see illustration) into its spectral components. It has better spectral resolution than any other available scanner.

MOCS weighs less than 20 lbs., has no moving parts, and uses only 7½ watts of power. Yet it has produced some fascinating information about the spacecraft on which we live. Recently, for example, we tested MOCS by flying it in an aircraft at 37,000 feet over Clear Lake in California. MOCS showed that the lake teemed with sediments, algae growth, and foreign matter. In fact, the only thing clear about the lake was its ironic name.

We're happy to be associated with the excellent work NASA is doing in remote sensing. We hope that MOCS and other NASA sensors will help make spacecraft earth a habitable home for us all.

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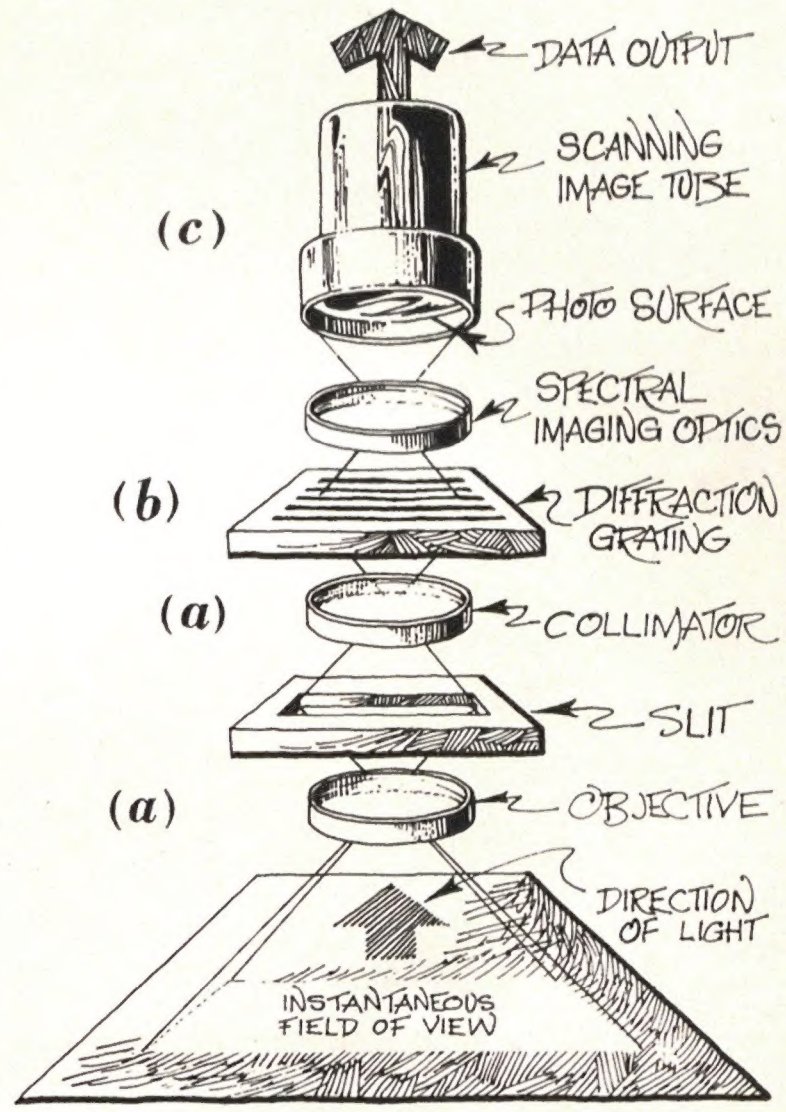
***Lenses (a) focus light through a slit onto a diffraction grating (b) which separates the light into its spectral components. These are focused on a dissector tube (c) which shows spatial variations of light across the field of view in one direction and spectral variations in the other. The raster scan then gives an electronic signal proportional to the spectral radiance of each spectral band in each element across the field of view.***

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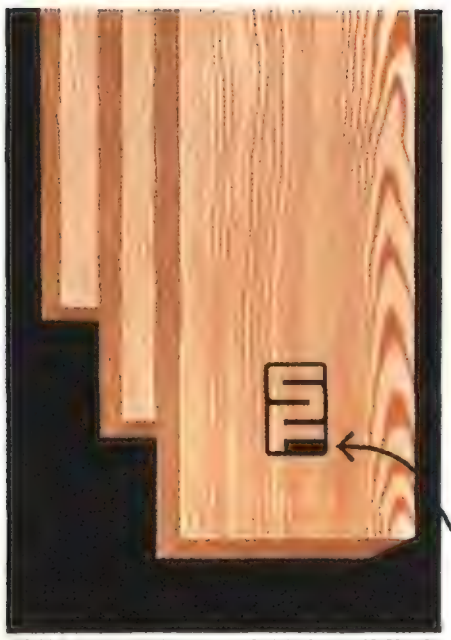

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The "Trees Forever" program, which is supported and made possible by the lumber manufacturers who display the SF mark, has many other environmental goals. If you'd like to know more about them, write to: Southern Forest Products Association, P. O. Box 52468, New Orleans, Louisiana 70152.

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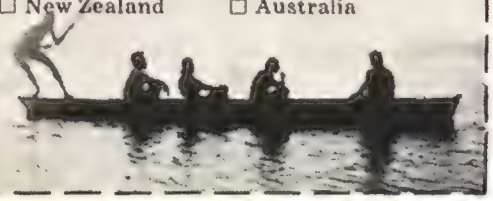

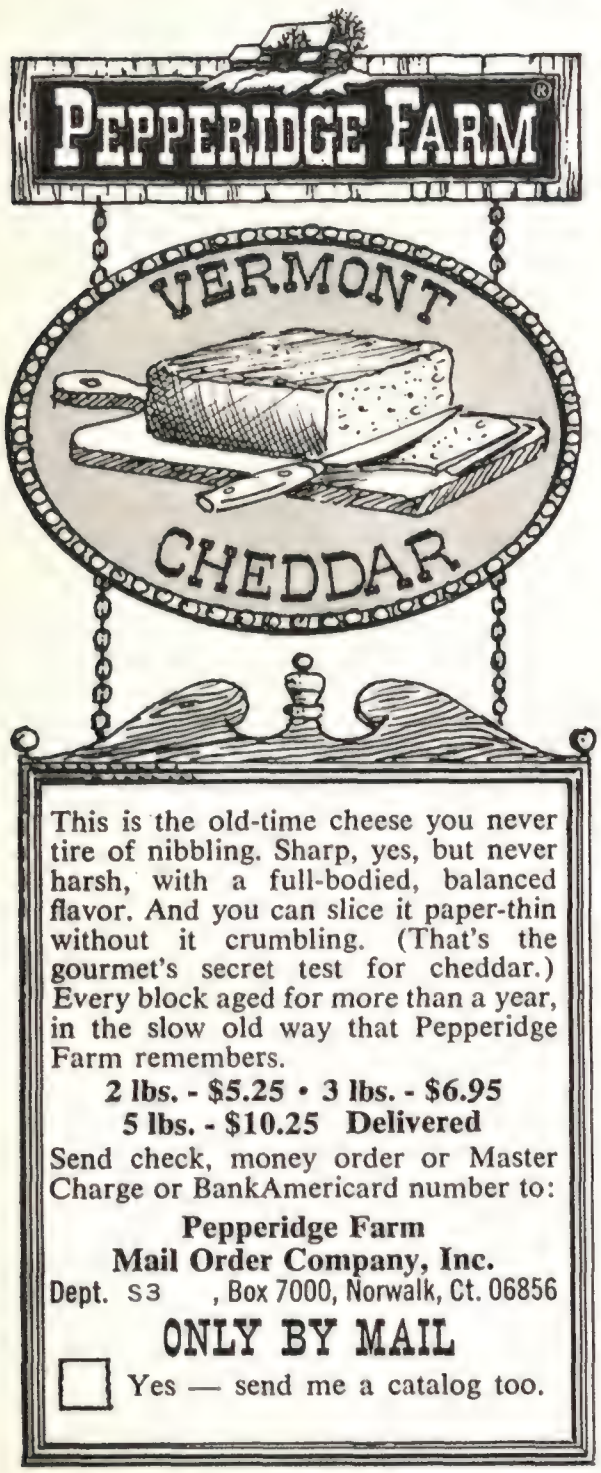


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# *Phenomena, comment and notes*

*Advice for horn blowers, bandicoots and numbats in trouble, Yosemite's first auto and progress in solar energy*

What appears to be a major breakthrough in the manufacture of solar cells for converting sunlight into electricity has been reported in *Energy Digest*. By combining various techniques including microcircuitry (as in transistors) and optical coating, physicists at the Communications Satellite Corporation, led by Dr. Joseph Lindmayer, have produced extremely thin silicon cells that have achieved the unheard of efficiencies of 18 percent on the earth. Conventional silicon cells used in space convert something like 10 percent of the solar energy received into electricity. The absolute maximum possible is 22 percent.

This brings the world considerably closer to the economic use of the sun as a direct source of power (SMITHSONIAN, November 1971). Indeed, without stretching it too far one can now envision residential and office buildings with optically coated—but still transparent—windows which would themselves produce sufficient juice to power the building.

*For the record*

A lot of motorists, facing the need to buy new cars equipped with emission-control devices, grumble that their gas mileage will be severely reduced. In fact, according to the Environmental Protection Agency, plenty of other gas-eating culprits, some far worse, have long been standard or near-standard equipment.

An emission-control device will cut fuel economy on the average of 7 percent, says EPA, but an automatic transmission cuts it by 6 percent (and think of all the young drivers who have never even learned to use a clutch).

Air conditioners are far worse: to cool off on a hot day in urban traffic costs you a 20 percent reduction in mileage per gallon. But the main culprit is size. A 3,500-pound car has 14 percent lower gas mileage than a 3,000-pound car.

*An inauspicious first*

The National Park Service is not the kind of agency that hands out ironic awards. If it were, it might well have an award for that person who has done least for each national park. And a leading candidate in the Yosemite division for such an honor, though posthumous, would be a gentleman named Oliver Lippincott who, on Saturday, June 24, 1900, became the first man to drive an automobile into what is now considered by some to be the world's most scenic parking lot.

The pioneering vehicle was a brand-new Locomobile Steam Car manufactured in Bridgeport, Connecticut, and it weighed 850 pounds with its gas and

Mr. Lippincott's Locomobile at Yosemite.

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Over-population and population imbalance are critical problems: too many people in a small area creates pollution; too many people on too little land to support them creates poverty, illness and hunger; too many people crowded into too little space creates frustration and anger.

Even though each country or culture feels it has its own best answer, population is a worldwide issue. Nations must work together while there is still time. Questions must be asked; solutions must be found.
**AtlanticRichfieldCompany**

artist: alan d'arcangelo
the joseph h. hirshhorn collection

water tanks full, according to James Zordich of the Los Angeles County Museum of Natural History, who reported his findings in a recent issue of the *Horseless Carriage Gazette.*

Having terrified a few horses and amazed a number of local people, Mr. Lippincott and his Locomobile labored to the top of Glacier Point overlooking the great falls, where they both perched awhile on a precarious overhanging rock. According to his own account, Mr. Lippincott felt a certain rapture not only at the sight before him but also at the thought of how he had come to see it. And with something less than accuracy he predicted: "Whatever the new style of conveyance, it cannot detract from the sublimity of the great valley or lessen the majesty of the eternal hills."

*The languages of science*

How many thousands of graduate students of science have labored long and hard to learn German, believing all the while in their heart of hearts that it was not only a waste of time but a typical anachronism of the sort that universities sometimes engage in?

The reason for this torture was that German was long the first language of scientific communication (having replaced Latin, thank heaven). But German began to diminish even by the turn of the century and has by now been completely overpowered by English. According to I. L. Kosin of Washington State University, writing in *BioScience,* English accounts for 70 percent of all scientific material abstracted in *Chemical Abstracts* and *Biological Abstracts.* German is a poor third. But before young scientists with little aptitude for foreign languages rejoice too heartily, they should be warned that the second language of scientific communication, and coming on strong, is Russian.

*Reprise on the Great Dismal*

In the July 1972 issue of SMITHSONIAN, conservationist Gary Soucie reported that one hope for saving what is left of the historic and mysterious Great Dismal Swamp that lies athwart the North Carolina-Virginia border was that the Nature Conservancy was looking into the matter.

In January, the largest single landholder in the Swamp, Union Camp Cor-

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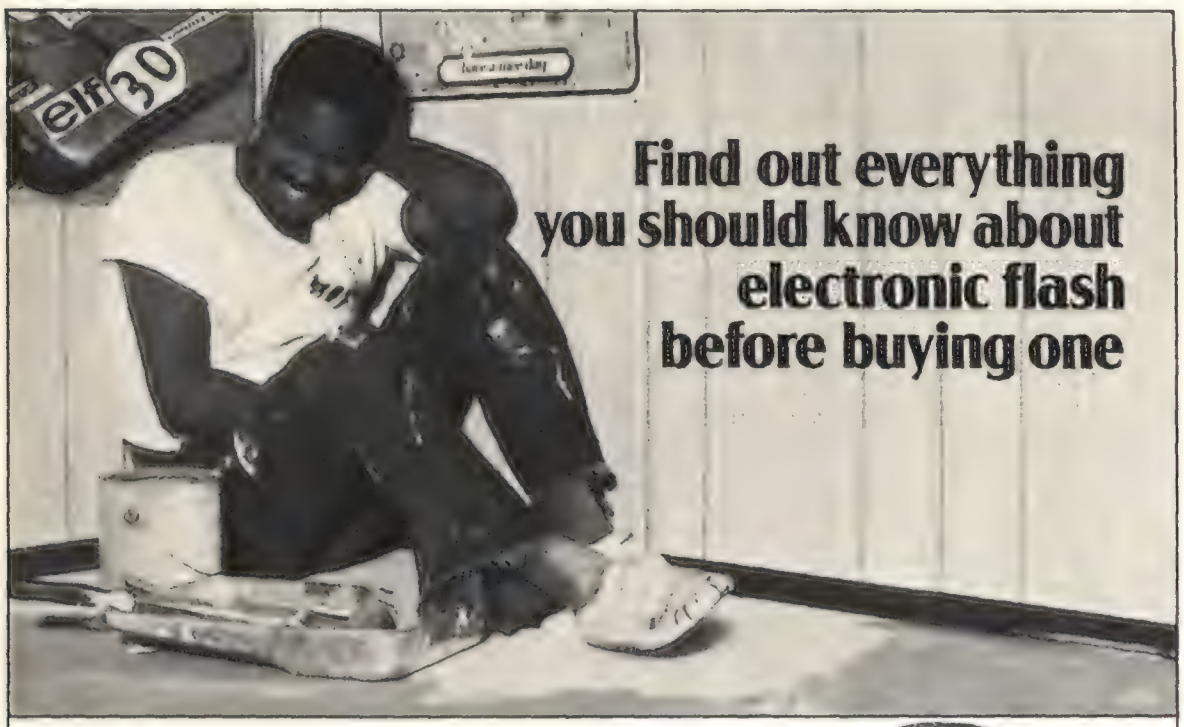


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poration, announced that it was donating all of its nearly 50,000 acres there to the Nature Conservancy, to be conveyed in turn to the Department of the Interior which will administer the area as a national wildlife refuge. This is the largest single land gift ever made to the Nature Conservancy and, though it leaves all the North Carolina side of the swamp and some of the Virginia side still in private hands, it will go a long way towards preserving what is one of the most unique wilderness areas remaining in the East.

*Difficulties down under*

In June 1972, SMITHSONIAN reported the findings of an Australian survey to the effect that kangaroos are safe from extinction and even more abundant now than in Captain Cook's time. That report has now been discredited by Australian officials and the U.S. Interior Department.

Secretary Rogers Morton has proposed that 17 Australian species (including the red, eastern gray and western gray kangaroos) be added to the list of endangered foreign fish and wildlife. Their addition to the list would prohibit the importation into the United States of any of these animals, dead or alive.

Beyond the more profound reasons why these 17 Australian species should be saved, there is another that may have

The numbat is a kind of anteater.

been overlooked. For if these species were to disappear, who would ever again think of naming something a numbat or a desert bandicoot or a hairy-nosed wombat or a quokka?

*Muscles and the mouthpiece*

Advice for would-be trumpet players has come from, of all places, *Nature* magazine. Two scholars working at Emory University, John V. Basmajian and Elmer R. White, believe that "neuromuscular con-

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trol of skillful motor performance reaches its acme in music."

So they hooked up the mouths of 18 trumpet players, ranging from concert artists to high school hopefuls, to a machine that records muscular activity and charted the results as each trumpeter performed a gig of 51 test items.

Contrary to what is apparently accepted dogma among trumpeters, a good player does not pit the lip muscles against the muscles surrounding the mouth to get the right "embouchure formation" in the mouthpiece. Instead, the muscles surrounding the lips do the most work. Also, they found that beginners use their upper lips more than the lower, which the scientists now know, having listened to all of this racket, is not the way to become the next Miles Davis.

*Clear-cutting*

Nothing is simple these days. It is getting harder to take a clear-cut stand even on something so widely vilified as the practice of harvesting timber by eliminating all the trees in an area in the manner of a man shaving his face. Such a practice seems to many conservationists like the typical bulldozer mentality, thoughtless and utterly destructive.

But, as *Science News* reports, two ecologists from Pennsylvania State University find that in clear-cut oak forests "plant production can be up to half that of undisturbed trees" within a mere three years. Quite aside from esthetics (and the motives of lumbermen who presumably did not have this research in hand when they began clear-cutting), this is a far better recovery rate than in selective harvesting wherein individual trees are cut, leaving others standing.

So the debate is further muddied, at least as far as oak trees are concerned.

*A small step for science*

If you, along with some anthropologists, have been worried that when protohumans got up on two legs, thus freeing their hands, they may have paid the heavy price of requiring more energy to get about, you may relax. Two Harvard zoologists have ascertained that chimpanzees use the same amount of oxygen whether they are running on two legs or four.

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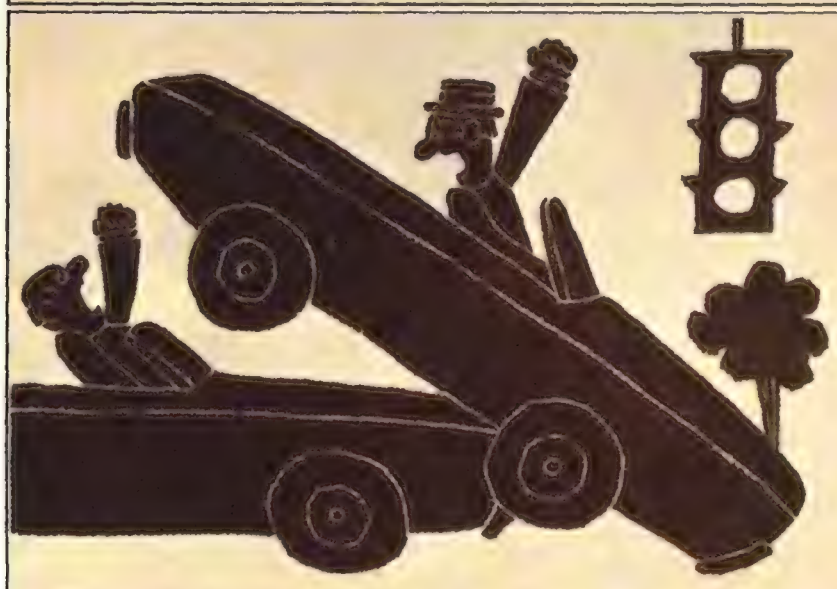
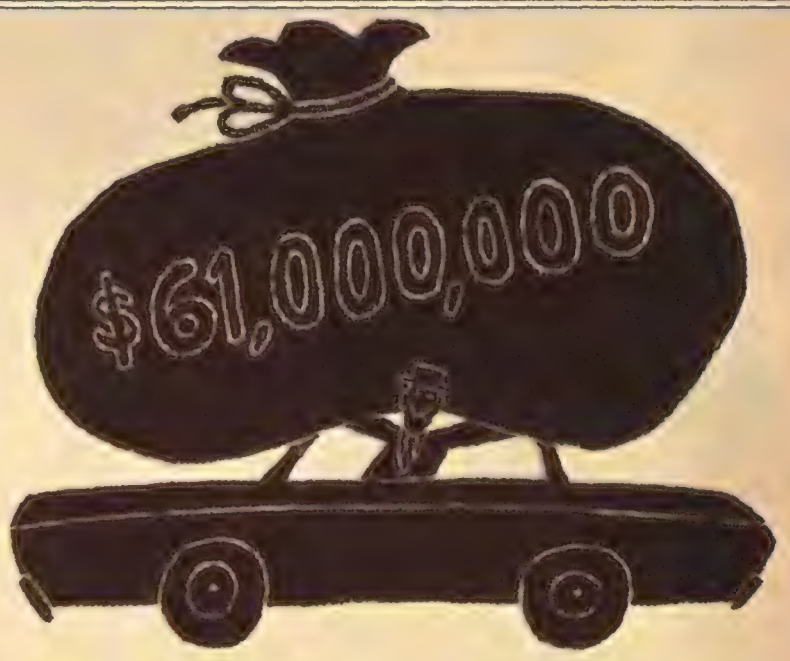


What's No-Fault? Simple. Accident settlements are based on *loss* instead of *blame*. Your insurance company pays your actual medical costs, lost wages and property damage. The other driver's company pays his. It's fast and fair. Lawsuits to decide fault are eliminated. So money is saved.




It works, too. For example, a No-Fault law became effective in Massachusetts in 1971. The first year alone saved car owners more than $61,000,000 on the cost of their auto insurance.

You'd expect an idea this good would spread fast, but only a few states have done anything about it. Where the law is strong and eliminates most lawsuits, insurance costs have come down. When the law doesn't reduce lawsuits, little is saved.

Most states have not acted at all.

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# *Letters to the Editor*

## *Dealers in rare stamps*

Dear Sir: David Snell's handsomely illustrated article in the January issue, "The Weills deal in the world's rarest of stamps," touches on the spirit of dedication—frenetic at times—of the true philatelist.

Recently, I found a letter illustrating this point. The envelope, postmarked "Lille, France, 1899," was addressed rather grandly: "A Sa Majesté, le roi de Samoa—via Suez et Sydney."

It said: "Sire: It is with ever-growing indignation that we, young Frenchmen, see perfidious Germany dare to provoke you. . . . All my sympathies are with you.

"Permit me, sir, to ask a favor of you. I realize how impudent it is . . . but I am a collector of postage stamps. The set of Samoan stamps is wanting in my collection. How will I be able to thank you if you would condescend to send them to me. . . . Marcel Dron, La Madeleine, Lille, France."

Oh yes, the French postage stamp in the upper right corner was missing. Doubtless the ruler was a collector too!
*John T. Gibson*
Washington, D.C.

## *Michael Ayrton*

Dear Sir: Thank you for your excellent article on Michael Ayrton. May I point out, however, that the two sculptures *Encounter* and *Reflex I,* credited to a Chicago gallery, should have been credited to my own gallery, Daedalus I, in Birmingham, Michigan.

As Mr. Ayrton's agent for North America, I first introduced him to his large Midwestern audience and continue to arrange exhibitions of his work in various American and Canadian galleries.

Incidentally, you might be interested in one of Ayrton's preliminary sketches (shown below) of *Reflective Head II,*

of which you published a full-page color photograph.
*Harold Patton*
Detroit, Michigan
*In the case of these two sculptures, Mr. Patton is correct.* Ed.

## *First Ladies' gowns*

Dear Sir: My only complaint is that the article by Peggy Thomson on the First Ladies' gowns did not include a discussion of many more of them.
*Mrs. Gerald S. Woodard*
Bloomington, Indiana
*More than half of all the First Ladies were discussed. Since the mannequins depicting the First Ladies are enclosed behind thick plate glass, reflection and dim lighting made it too difficult to photograph all of this inaugural finery.* Ed.

## *Phenomena, comment and notes*

Dear Sir: I feel slighted! The conclusion reached by sociologists Jonathan and Stephen Cole, as reported in "Phenomena, comment and notes," that fewer physicists are necessary because the significant advancements are made by a few, is erroneous for at least two reasons: 1) Many "lesser" physicists are required for the development of these advancements (and probably had a hand in the writing of the paper in the first place). 2) The distinguished "elite minority" will have

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to be replaced from within the ranks at some point in time.

I am not a great man in my field but maybe *next* year I will write that paper to place me in this category!

*Robert A. Sullivan*
Arlington, Virginia

*As we suggested in the final sentence, "it would be interesting to see what some of the idle physicists might turn up if they began to look into sociology."* Ed.

## *Doppler effect*

Dear Sir: In Letters to the Editor, the explanation of the Doppler effect was abbreviated into an error.

Doppler's principle describes the effects upon the apparent frequency of a wave train (sound or light) produced (1) by *motion* of the source toward or away from the stationary observer, and (2) by *motion* of the observer toward or from the stationary source; the motion in each case being with reference to the (supposedly stationary) medium.

The next time the Editor is caught on the highway by a Doppler radar trap and ticketed for speeding, he should realize that what gave him away was the *rate* at which his distance to the radar was changing, and not the distance itself.

*Cornelius Van S. Roosevelt*
Washington, D.C.

## *Patrick Ryan*

Dear Sir: Patrick Ryan thinks that wars are too serious a matter to be left to people and suggests that we delegate the whole mockery to RPVs (Remotely Piloted Vehicles) and similar paraphernalia controlled by the "button." I voice my doubts in verse:

*H. G. Wells (sic Patrick Ryan),*
*Inveigled by transistors,*
*Foresees the everlasting last*
*Of blood and draft resisters.*

*Ah BUTTON! How I wish you could*
*Play faultlessly Houdini,*
*Mechanically disposing of*
*Herr Hitler, Mussolini.*

*But that is not, I fear, to be*
*The bloodless fate of man:*
*When Belsen threatens Camelot*
*Raw flesh does what it can.*

*Stuart C. McKelvey* (Col. USA, Ret.)
Tiburon, California

# The American forest still belongs to the American people.

33% public and private forestland not suitable for commercial trees, or set aside for parks and wilderness areas.

19% state and federal forestland.

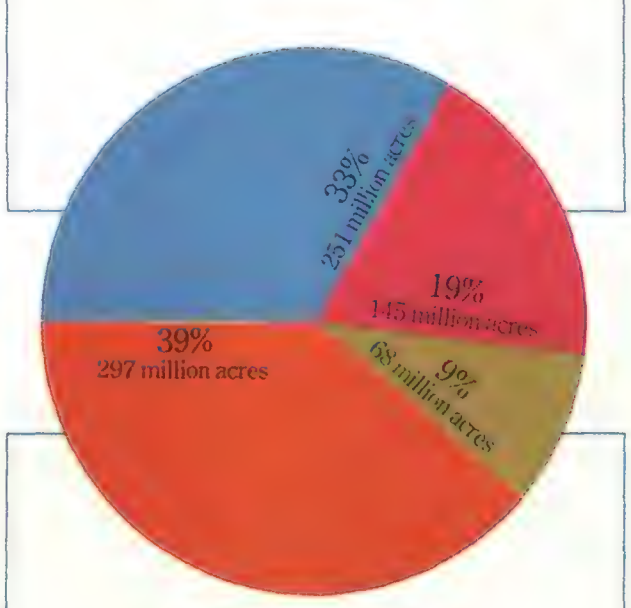
And to a *lot* of people.

To begin with, four million individual Americans own 39% of the entire forest—a forest that's still nearly three-fourths as large as it was when Columbus landed.

Then, too, *everybody* shares ownership in that 19% of the forest owned by federal and state governments which supplies so much of the raw material for building our houses and cities and making our paper products.

And when you add the 17 million acres of forestland that's been set aside for parks and wilderness areas, and the government land not suitable for growing commercial trees, the American people—individually or collectively—own 91% of America's 753 million acres of forest.

So if the forest industries seem to own more than their 9%, it's probably because with responsible, scientific management they've been able to make this 9% produce 26% of all the raw material we need for today's wood and paper products, and still keep America green and growing.




Source: Department of Agriculture, U.S. Forest Service

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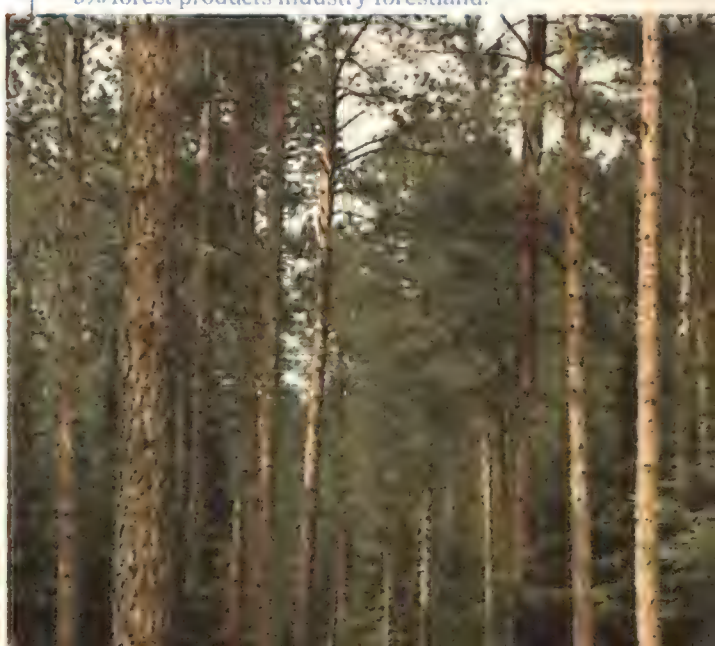

# After carefully considering how to improve telephone service

At one end of the island of Maui, the village of Hana lies almost isolated. On the island's central plain stands Wailuku, Maui's largest city, and the bulk of the island. In between, presenting a nearly impassable barrier, looms Haleakala, the world's largest dormant volcano.

Haleakala, the House of the Sun, where, according to Hawaiian legend, the demigod Maui caught the sun by its rays and refused to let go until it had promised to pass by more slowly, allowing Man more daylight in which to harvest his fields and bring in fish.

Haleakala, sometimes snowcapped even in this tropical climate, rising some 10,000 feet over the island, and plunging almost perpendicularly down to the sea. With a moonscape crater larger in circumference than Manhattan island.

Any way you look at it, a tough place to run telephone lines.

So the Hawaiian Telephone Company, a subsidiary of General Telephone & Electronics, updated the ancient legend by using the top of Haleakala to catch radio microwaves instead of sun rays.

Since microwave beams travel in a direct line-of-sight, Hawaiian Telephone's Hana station transmits calls to a relay station atop Huehue Mountain, 65 miles away on the big island of Hawaii. From there, the signals are beamed back across the water to the relay station on Haleakala,

GTE, 730 Third Ave., New York, N.Y. 10017

# between Hana & Wailuku, we decided not to move the volcano.

and from Haleakala, the microwave signal hops to the company's call-switching center in Wailuku.

The straight-line distance covered by the Hana-Wailuku link amounts to 157 miles, even though the two points are only 35 miles apart. Nevertheless, the microwave relay system cost less than half of what building a cable route would have cost.

Bringing people closer together with microwave relay systems has become a substantial part of General Telephone's business, not just in Hawaii, but all over the world. In Africa, South America, the Middle East—wherever normal telephone line installations are impractical—GTE International, another GTE subsidiary, has provided better, faster and cheaper communications.

In the last 15 years alone, we have built microwave systems in 51 different countries.

Perhaps this isn't the stuff that legends are made of, because, after all, our work is less dramatic than a demi-god capturing the sun. But we think that making it easier for people to communicate with each other is important enough work for mere mortal Man.

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*By Donald Gould*
*Photographs by Erich Lessing*

Before a romanticized painting of the astronomer in the Copernicus Museum at Frombork, where he did his great work, four American students examine replicas of his astronomical equipment.

# The Poles celebrate their national hero, Copernicus, on his 500th anniversary

The students, from left to right: Gregory Perczak, Bruce Dolego, Katharine Park and Clifford Martin.

*On a pilgrimage to Poland, four Americans follow the footsteps of the solitary genius who changed Man's concept of the universe*

Just before Christmas four young American students—three boys and a girl—landed at Warsaw airport to begin the pilgrimage of a lifetime. They were Katharine Park, a Harvard graduate studying the history of science in London; Gregory Perczak, a senior at Notre Dame specializing in the philosophy of science; Bruce Dolego, studying mathematics at St. Johns College in Annapolis, Maryland; and Clifford Martin, a graduate student in physics at Pennsylvania State University. Sponsored by the Copernicus Society of America and by the Smithsonian Institution, this journey was the first "project" in the Smithsonian's fifth international symposium, with the main events taking place in Washington, D.C., next month.

The four students were setting out on a fortnight's journey across Poland from Krakow in the far south to Frombork near the Baltic coast. Their purpose was to see all that they could of the places and things which had played a part in the life of Poland's greatest national hero—Nicolaus Copernicus, the solitary canon who transformed Man's concept of the universe.

This is a record of some of the things they saw and learned along the way.

Copernicus was born on February 19, 1473, in the busy port of Torun, which lies on the Vistula River about 100 miles from the sea. This year therefore marks the 500th anniversary of his birth, and there are great works in hand all through the country, aimed at restoring or reconstructing all the remaining relics of the immortal mathematical recluse.

Nicolaus was the second son of a prosperous copper merchant, a member of the powerful, closed circle of prelates and traders who virtually ruled such cities at that time. His mother and two sisters completed the group. The young Copernicus was born into an easy

This copy of his portrait, probably from life, hangs in the town hall at Torun, his place of birth.

life, enjoying comfort and privilege, but not so much as to excite the dangerous envy of powerful neighbors. One particular family connection was to shape his whole career. His mother's brother, Lucas Waczenrode, became the bishop and prince of Warmia, a patch of territory rather smaller than the state of Delaware and shaped like a crumpled leather bottle with a narrow neck that reached the shore of the Gulf of Gdansk.

When Copernicus was a youth, Uncle Lucas' see of Warmia formed a virtually autonomous buffer state between the lands still held by a turbulent semireligious order, the Teutonic Knights, and the country over which the Polish court had full authority. The Bishop of Warmia was therefore responsible not only for the spiritual welfare and the temporal control of the inhabitants of his own diocese—he also played the role of diplomat and high constable, keeping an eye on the unruly ex-crusaders, and nipping in the bud their not infrequent attempts to stray beyond the borders of their fiefdom and nibble away at Poland.

None of this might have mattered in the least to Nicolaus Copernicus but for the fact that his father died when he was ten. Uncle Lucas, then a mere canon on the cathedral staff at Frombork, where the narrow neck of the see of Warmia reaches the coast, promptly took charge of Nicolaus and his older brother, Andreas, and the two girls.

For the time being they were left at Torun to finish their schooling. The present burghers of the town believe they have found the very building where the brothers absorbed the three Rs. It is now a school for nurses, looking entirely part of the industrial age, except for a couple of arched medieval red-brick window frames with painted transoms which have been discovered and uncovered under many later layers of daub and plaster. Poland (and perhaps this is true of every country kept poor across the centuries because of constant wars or mean resources) remains rich in material remnants from the past. The old is not destroyed to make place for the new.

At the age of 18 both of the boys left their home in Torun and enrolled as students of the University of Krakow. Dr. Karol Estreicher is the present professor of the history of art at the University of Krakow. He is a living and remarkably lively example of the kind of continuity of culture and tradition which has kept Poland a nation despite the most tempestuous history of invasion and appropriation which any society has had to endure over the past 1,000 years. The professor is the fifth Estreicher in successive generations to have held a chair at the University of Krakow.

Professor Estreicher explains that in the 15th century, Poland, and especially the capital city of Krakow, was a major center of European culture, and the University of Krakow was an adventurous-minded modern school, particularly strong in mathematics, and stirred by the new intellectual movements of the Renaissance.

There was a considerable German colony in Krakow, and no clear line—either cultural or cartographical—could be drawn either then or since to mark the place where the one nation gave way to the other. Copernicus has, of course, become one of the immortals, and

his is one of those names like Plato, Shakespeare and Leonardo da Vinci, which shed a permanent glow of glory on the nations which can claim them for their own. For something like a couple of hundred years there has been a sterile dispute between the Germans and the Poles as to the true nationality of the great cosmologist from Torun.

Says Estreicher: "When Copernicus was a student there were two important centers of influence in Krakow—one was the court and the other the university. The German colony was important, but perhaps comparable to the Polish colony in Chicago today. It wasn't the center of things. The court and the university were run by Poles. The aristocrats were Poles, the clergy were Poles, and so were most of the professors."

To this extent, and also because Copernicus was born in an undoubtedly Polish town, the nation can claim him as her son. But perhaps the most significant clue to the true seedbed of the Copernican mind is in Professor Estreicher's comment: "Somebody asked me if Copernicus spoke German or Polish. Surely he knew both languages—he thought in Latin. If you or I speak with a peasant we talk in the peasant's language, but we think in our language, and *his* was Latin."

Presumably, Copernicus was a Pole. Certainly he was a European, and a child of the Renaissance.

The Copernicus brothers left Krakow without a degree, but so did a great majority of their fellow students. They went home to Torun for a time, and Uncle Lucas, who was by this time the Bishop of Warmia, planned to provide them with a living in the Church, for whose servants there was an almost guaranteed lifetime of comfort and security and power.

The Bishop had it in mind to place them as canons of the cathedral at Frombork, but until a vacancy opened up it was decided that the Copernicus brothers should use the interval for continuing their education in Italy. If Krakow was a modern, forward-looking school, Italy was the very source of the Renaissance and the new humanism.

Nicolaus went to Bologna at the age of 23. Later he moved to Padua, and it was nearly ten years before he came home to Poland for good. He studied a little of everything, including medicine, and Karol Estreicher believes he may have been the first Pole to have taken part in the dissection of the human body.

We do know that he took a degree in canon law. Perhaps this was because, shortly after he had left Torun for Bologna, he was made a canon of Frombork. From that time on Nicolaus drew his canon's stipend, but, by permission of the Warmia chapter, he remained an absentee official for the next eight years.

Copernicus was born in the third house from right and baptized in the church in the background.

During the Italian period the Copernicus brothers drew apart. Nicolaus clearly remained respectable, while Andreas lived the wild life. Uncle Lucas made Andreas a canon of Frombork only a couple of years after Nicolaus' preferment, and he, like his brother, was allowed to continue as an absentee student. But there are records of Andreas falling into debt, and when he did return to Frombork he was suffering a pox which might have been leprosy or syphilis. Probably it was leprosy because he was disfigured and clearly repulsive to his fellow clerics. In the end the chapter paid him a pension to go away. He died somewhere and at some time not long afterward, but nobody knows exactly where and when.

Nicolaus Copernicus returned to Poland in 1503 when he was 30 years old and his uncle had him seconded to the bishop's palace in the town of Lidzbark, where he acted as the prelate's personal physician, secretary and general factotum. It seems that this "immortal" was perfectly content to be the lackey of his powerful patron. There was no sign, in his daily life, of the revolutionary—the man prepared to ignore the most sacred tenets of his culture when they offended the demands of reason. He was submissive, efficient and

*In previous issues of* SMITHSONIAN, *Dr. Gould has written about the Delta Project in Holland and some of Great Britain's antipollution efforts.*

Little has changed in the landscape Copernicus saw when he served as his uncle's assistant at Lidzbark.

orthodox. Copernicus remained the lieutenant of his uncle until 1510.

Before the Bishop's death in 1512, Copernicus had moved to Frombork Cathedral to lead the life of a common canon. He had lost both the benefits and the obligations of being the nephew of the ruling bishop. He was given quarters in one of the red-brick towers built into the fortress walls enclosing the cathedral precincts. Except for a four-and-a-half-year period when he served as administrator in Olsztyn, helping with the defense against the Teutonic Knights, he lived in the tower house at Frombork for the next 30 years until he died.

In fact it appears that none of his fellow clergymen at Frombork regarded him as anything more than a somewhat moody and introverted colleague of no particular talent. His astronomical work was of no interest to them. Certainly they were at no pains to mark his grave when he died; all canons were buried in unmarked graves. The present chapter members show a touching sensitivity about the failure of their predecessors to give the cathedral's greatest son due honor, and when asked where Copernicus lies, they are embarrassed, but do a little quick talking about a number of human bones unearthed just recently by workmen laying electric cables close to the place supposed to have been the canon's private altar.

Astronomy and mathematics were subjects of major concern to the teachers and students of all the universities attended by Nicolaus Copernicus. But when he was a student, it was supposed that the firmament of heaven consisted of a series of spherical shells surrounding the Earth, which lay fixed and still at the center of it all. The shells revolved, together with the celestial lights attached to each layer.

The planets were a nuisance in an otherwise happy scheme of things, but Ptolemy the Alexandrian had explained their apparent indiscipline as long ago as the second century. He supposed that the planets did indeed circle the Earth, but he also supposed that each of them performed a second, smaller, private dance of its own—like that of a spot on the tire of a motorcycle being driven around a wall of death, with the Earth standing at the center of the pit. The Ptolemaic system therefore satisfied both common sense, and also the precepts of an all-powerful church which taught that Man was the chief work and principal concern of a God who had fashioned the entire structure.

Copernicus would have been taught Ptolemaic astronomy at Krakow, Padua and Bologna—not as an interesting theory, but as the only proper astronomical theory. But the Ptolemaic model did not explain all astronomical observations.

A full 17 centuries before Copernicus was born, the Greek, Aristarchus of Samos, had argued that the world revolves around the sun, but his theories were entirely forgotten with the decay of classical culture. A re-examination of Greek and Roman learning, with a view to reviving neglected but valuable attitudes and concepts, was a major preoccupation among Renaissance scholars, and during his ten years in Italy Copernicus might have come across these early theories.

Copernicus lived in this castle in Olsztyn for a few years, helping defend it against the Teutonic Knights.

Under these circumstances the largely ignored ideas of the ancients, which raised the possibility that the Earth was simply one among the host of moving heavenly bodies, could well have appealed to the young scholar. There are no means of knowing when Copernicus first began to favor the idea of a sun-centered planetary system. While a student at Bologna, he had lodged and worked with a Professor Domenico Maria da Novara, a famous astronomer, and had helped make observations needed for the compilation of astronomical tables. Novara was a widely known critic of the Ptolemaic system, because it failed to explain some of his own painstaking contemplations of the sky. They must have discussed such difficulties, but there is nothing on record to suggest that Novara had any revolutionary ideas of his own, or that he wanted to do more than simply improve upon the Ptolemaic pattern.

There are some slender grounds for arguing that the Copernican universe was, indeed, the fruit of solitary contemplation, since the first hint of the ideas forming in the canon's mind was contained in a short essay *(Commentariolus)* which he wrote at about the time of his uncle's death. So it is reasonable to imagine that the arguments set down in this document had been forming over the previous five or six years.

One of the great principles influencing the astronomical theorists, including Copernicus himself, was the belief that all the motions of the stars and planets must proceed in perfect circles, since the circle was the "perfect" form, and so the pattern which a Creator of perfect edifices would have employed. Copernicus explains in an introduction to his treatise that a major source of his dissatisfaction with the Ptolemaic scheme was the need to assume that the planets varied the speed with which they followed their set courses. Only by assuming that they sometimes traveled faster and sometimes slower, could Ptolemy's model be made to account for their known behavior, if the concept of their circular movement was to be sustained. Copernicus wrote, "Having become aware of these defects, I often considered whether there could perhaps be found a more reasonable arrangement of circles . . . in which everything would move uniformly about its proper center, as the rule of absolute motion requires."

The Copernican scheme involved accepting a number of propositions which were unorthodox, if not outrageous, by contemporary standards, and these he then explained in almost brusque terms. They included the real secret of the release of the mind of Man from the concept of an Earth-centered universe, which was an

appreciation of the fact that the apparent movement of the firmament around the Earth could equally well be due to the Earth's spinning on its own axis.

The canon's assumptions also included the facts that the Earth is not the center of the universe, but only of the orbit of the moon, and that the sun is the center of the planetary system, and that the distance from the Earth to stars was far greater than had been supposed.

There were certain other concepts, which, together, amounted to a nearly faultless statement of the broad geography of the universe as we now understand it. However, this brief, brilliant exposition contained no sort of proof for the fundamental assertions it contained. There was a curt promise that proof would follow later in a larger work.

The *Commentariolus* was not printed, but circulated in manuscript form among various unidentified scholars. And yet it was enough to excite a good deal of talk and thought within the few centers of Renaissance learning.

Nicolaus Copernicus had retired to his red-brick tower at Frombork at the age of 48. While he may have been a recluse in the sense that he kept his thoughts and emotions largely to himself, he remained a man of affairs. For a number of years after taking up residence in Frombork he administered several of the chapter's territories. Records survive of his stewardship, which give details of his meticulous dealings with tenants and servants and tradesmen.

It was against this background that the massive *De revolutionibus orbium caelestium* was written, in which the canon argued out in detail the ideas presented in his early essay. It seems that the labor may have lasted some 20 years, spanning the time between his arrival at Frombork and about 1530, when he appears to have completed the job and then to have locked the thing away.

Inevitably, perhaps, Nicolaus is nowadays presented to the world as a dedicated star-gazer, and among the impedimenta decorating a great canvas hanging in the new Copernicus Museum at Frombork there is something looking remarkably like a telescope, despite the fact that this spyglass on the skies was not invented until more than 60 years after his death.

Indeed, Copernicus had learned how to use the simple instruments of his time during his student days, and must have made numerous astronomical observations during the many years of creation of his great plan of the universe.

Coupling his own observations to the tables of the motions of the stars and planets compiled long ago by Ptolemy and even earlier observers, he discovered that the planetary orbits had changed. Such close astronomical observations lent weight, though no particular proof, to his concept of heliocentricism. Indeed, this achievement was an almost purely intellectual tour de force, like that of Einstein.

The titillating ideas set out so plainly in the *Commentariolus* had excited a number of scholars all over Europe. In 1536 Cardinal Nicholas Shoenberg, who was a considerable power in Rome, wrote to Copernicus to say that he had heard of his ideas, and asked for

American students sit beneath faculty portraits in the aula of Copernicus' college in Krakow.

At Krakow's Collegium Majus, Bruce Dolego examines astronomical drawings of the kind Copernicus used.

more information. He said "I beg you most emphatically to communicate your discovery to the learned world, and to send me as soon as possible your theories about the universe, together with the tables and whatever else you have pertaining to the subject."

We know that this letter pleased Copernicus, but it was not enough to persuade him to release the secrets of his reasoning.

In 1539 a young man called Rheticus arrived at the cathedral from the University of Wittenberg, where he was professor of mathematics. He had intended to stay in Frombork for about two weeks, but as things turned out, he was to be in and out of the place for the next couple of years. It was Rheticus, backed by a friend of Copernicus, Bishop Tiedemann Giese, who finally persuaded Copernicus to publish *De revolutionibus.* Slowly the two of them wore down the resistance of the reluctant genius, and as a start Rheticus was allowed to write a résumé of the masterwork which was printed in Gdansk in 1540.

During the following year Rheticus copied out the entire manuscript of *De revolutionibus,* and he arrived with the precious text in Nuremberg in 1542, where the work began of setting it up in type. As it turned out, Rheticus didn't complete the task of presenting the ideas of Copernicus to the world. He was offered a good job in Leipzig, and he took it. He handed over the responsibility for seeing *De revolutionibus* through the press to a Lutheran clergyman with a mathematical bent called Andreas Osiander.

Osiander wrote an unsigned preface to Copernicus' text in which he attempted to anticipate criticism by explaining that the ideas described in the book need not be taken as truth, and that it was simply an exercise in logic, by no means designed to upset traditional concepts of the universe. In those days, one did not reach truth by geometrical theorems but by theology. The preface even attempted to show how some of the propositions contained in the text were untenable.

When the first copies of *De revolutionibus* came off the press Copernicus lay dying in his red-brick tower. He had suffered a series of strokes, and was helpless and almost senseless. One story has it that a copy of the Nuremberg edition of his book was put into his hands, and perhaps he was still sufficiently aware to know what it was, but was too far gone to read the

preface which denied the author's faith in what he had to say.

There was also a humble dedication to Pope Paul III, in which the canon set out to excuse the temerity he was showing in publishing ideas so opposed to popular opinion and common sense. The dedication refers to some of the classical authors who had imagined a moving Earth, and ends by imploring the Pope to ignore the attacks by ignorant critics.

In fact, the great work caused remarkably little stir, either from critics or supporters. Professor Estreicher claims that there were members of the faculty of the University of Krakow who immediately recognized the genius of their great alumnus, and who sustained and preached his doctrines, but it was to be another century or so before the work of men like Keppler and Newton confirmed to the world at large the supreme importance of Copernican ideas. It even took half a century for his critics to get moving properly.

*De revolutionibus* was only placed on the Index of banned books by the Roman Church some 80 years after the canon's death. Later the Church published "corrections" of the text and it was removed from the Index in the 1830s.

So Copernicus died unwept, unhonored and unsung. Indeed, in his later years he had become something of an embarrassment to his colleagues, an old man of strange habits. There are surviving letters which passed between the canon and his bishop concerning a serving woman in Copernicus' household. Her presence had been causing, rightly or wrongly, something of a scandal in the neighborhood. The bishop wanted the canon to send her packing. She did go in the end, so that particular problem was resolved, but one can imagine that there was probably a general, if decently muted, sigh of relief to be heard around the chapter when the old man died.

Today Copernicus is a national hero of such stature that his name is magic.

All over the country millions of dollars have been spent on restoring castles, churches and entire streets to the state in which he knew them. The four student pilgrims were allowed to turn the pages of the original manuscript of *De revolutionibus* in the Jagiellonian Library in Krakow, and in the town of Olsztyn they saw letters written by Copernicus during the troubles with the Teutonic Knights.

Let Professor Karol Estreicher have the last word on the nature of this lonely cleric who played such a major role in shaping Man's attitude toward his position in the scheme of things, and who has taken first place in the ranks of the heroes of a fiercely patriotic nation.

"He was a typical modern man of science. He had no real care for politics. He was timid—even weak—with the weakness of a man who wants to be alone and not to be involved. Not brutal. Not seeking influence and power. There are not many people like this."

SMITHSONIAN's *celebration of Copernicus' birthday will continue with an article by Dr. Jacob Bronowski, of the Salk Institute.*

The manuscript of *De revolutionibus:* Katharine Park holds finger over imprint of Copernicus' pen which placed the sun in the center of the solar system. At right, a Renaissance globe at Krakow.

*Text and photographs*
*by Richard Bell and Jeremy Grimsdell*

# The black lechwe is an antelope to be preserved

*Amid the amazing natural bounty of Zambia's vast, watery floodplain, a rare animal and an ancient life-style are both now under the gun*

A lone lechwe pauses before a wide ribbon of black open-bill storks and other marsh birds,

"A grassy sea [surrounds us] on all sides. . . . The wind on the rushes makes a sound like the waves of the sea. The flood extends out in slightly depressed arms of the Lake for twenty or thirty miles, and far too broad to be seen across; fish abound, and ant-hills alone lift up their heads; they have trees on them. . . .

"The amount of water spread out over the country constantly excites my wonder; it is prodigious. . . .

"Men were hunting, and we passed near large herds of antelopes, which made a rushing, plunging sound as they ran and sprang away among the waters. A lion had wandered into this world of water and ant-hills, and roared night and morning, as if very much disgusted. . . ."

So wrote the missionary-explorer, David Livingstone, in his journal in late March and early April 1873. A month later and 50 miles farther south in what is now Zambia, Livingstone was dead. The spot where he died is marked by a memorial that stands alone in the quiet woodland on the southern edge of the great floodplain of Lake Bangweulu.

The Bangweulu basin is a shallow depression in the plateau of northern Zambia, a Central African country that lies just south of Tanzania and Zaïre. It is the site of an extraordinary assemblage of wildlife, and probably the only home of a magnificent antelope, the black lechwe.

The level floor of the basin is 100 miles across, and the gentle slopes much wider. More than 20 rivers flow into the basin, creating a marshy habitat one rarely associates with Africa. Each year, the basin floor is inundated to a depth of several feet, and all the sand and fertile alluvium from the surrounding plateau are dropped in the basin. Each dry season the floods recede, exposing hundreds of square miles of water-meadow grassland. Because of the difficulties of communication in the world of water and anthills, development has passed it by.

On the eastern side of Lake Bangweulu there is a huge triangle of permanent swamp, covering 1,000 square miles in the center of the basin, a bewildering maze of channels, lagoons and shallow lakes. Along the channels deep in the swamp, the pervading atmosphere is of isolation and quiet. Occasionally a crocodile slides off a sandbank, and the stillness is broken by the churning splash of a crash-diving hippo. But below the surface of the crystal clear water, the impression is of vigorous life; in the deep, swift-flowing channels, shoals of tiger fish can be seen hunting through the streaming fronds; in the shallow lily-covered la-

*The authors are both zoologists with Zambia's Black Lechwe Project. Dr. Bell, a Kenyan, worked previously in the Serengeti; Dr. Grimsdell, of England, studied buffalo in Western Uganda.*

only part of the profusion of wildlife living
in the Bangweulu floodplain's fertile meadows.

goons, the heavy-headed catfish noses lazily through the dense weed.

In the southeast sector of the swamp, a string of large sandbanks and sand islands rises, where the swamp people build their permanent villages—clusters of tightly packed huts on the driest spots—and cultivate their only crop, cassava, planted on the mounds that Livingstone had seen. Originally, these islands were covered by forest, but since the arrival of man in the last four centuries all the forest has been cleared and the thin forest soil exhausted. Now the islands are treeless and barren, the cassava crops pitifully declining in the depauperated sand.

Except for these island settlements, the floodplain is a study in richness. American fishery scientists have shown that the standing crops in parts of the Central African floodplains are among the world's highest.

Birds abound: white-faced tree duck, fulvous tree duck, African pochard, spur-winged goose, knob-billed goose, pygmy goose and Egyptian goose. The clatter of their panic takeoff interrupts a canoe's quiet glide through the overhung channels. The disreputable marabou stork stabs sordidly at catfish in the quivering mud; the saddle-billed stork excuses the same action by its elegance. The silence of a grass-ocean anthill-atoll is shattered at evening by the express-train roar of tens of thousands of Abdim's storks and open-bills rising in unison.

The trees and woodland grasses of the plateau, growing as they do on the ancient, infertile land surface, are generally unproductive except of fiber, and are of poor food value to herbivores. In consequence, the wildlife of the Central African miombo belt (an open woodland) has always been sparse, and even the earliest European travelers were struck by the scarcity of game in its monotonous tracts. But those who penetrated the great floodplain basin were uniformly amazed by the number of animals to be seen grazing the richly productive water meadows. This abundance has been decimated in the past half-century.

In both world wars, supply routes carrying men and equipment passed through Bangweulu and the game was systematically slaughtered to feed the troops. Between and since the wars, traditional hunting methods have been augmented by the uncontrolled use of firearms. Regulated subsistence hunting by the swamp people has been supplanted by a cash trade with the nearby copper belt, where a large, wealthy, urbanized but meat-hungry population has sprung up around the mines.

A cluster of anthills in the floodplain supports a small fishing camp of the swamp people.

Though no species has been completely exterminated in the basin (with the possible exception of the rhinoceros), many species have suffered drastic reductions. It is the antelope population of Bangweulu that is the prime target for hunting, particularly the once amazingly abundant lechwe, still the most numerous mammal of the Bangweulu basin. This is the most distinct of three subspecies of lechwe, the characteristic antelope of the Central African floodplains. Of its relatives, the largest and most numerous, the Kafue lechwe, occurs in a single population of about 90,000 on the Kafue flats in southern Zambia, while the red lechwe is widely but sparsely distributed in the drainages of western Zambia, Angola, Botswana and southern Zaïre.

Very few black lechwe are really black: The females and young can be distinguished from their red-gold cousins by a grayer tinge to the rufous coats. The most marked difference is in the adult males. At the time of maturity, the male black lechwe resembles the Kafue lechwe in being marked by a black stripe on the front of the foreleg and shoulder. But in the black lechwe the black area spreads up the sides of the throat and neck, along the lower flank and onto the front of the haunch. The parts that turn black first are those that are visible from the front, except for the white throat and face patterns which are startlingly outlined. The facade is therefore presumably a social signal in the continual head-on sparring between males in the rutting season of January through March.

If the black lechwe still exists in parts of its former range outside the Bangweulu basin, it is as scattered individuals, so that the survival of the subspecies depends on the Bangweulu populations. All witnesses before World War I agree that large numbers occurred in areas where none or very few survive today. A district officer stationed in the swamp in 1922-23 estimated that at that time the total population could have been as many as 600,000, even following the slaughter of the First World War. He wrote: "In December 1922, black lechwe were to be seen in the tens of thousands on both sides of the channel all the way from Mukuku to Nsalushi Island (about 80 miles). In fact, lechwe were to be seen in every direction, and when one of the vast herds started to move, the whole horizon appeared to undulate."

When the same officer returned to the swamps in 1927, he "was quite shocked to see how the herds of lechwe had diminished. I gave my opinion that at the then rate of slaughter, it was only a matter of time before the black lechwe was exterminated."

A drastic reduction was noted in succeeding estimates, which finally appeared to stabilize in the 1950s at about 15,000 lechwe. But in 1966 observers were able to locate only 4,000 black lechwe.

This shocking news precipitated action. The black lechwe was included in the Red Data Book of endangered animals of the International Union for the Conservation of Nature and Natural Resources, and the foundations of a system of effective law enforcement were laid. In 1968, the Anglo-American Corporation of Zambia gave a grant of £70,000 to the Zambian National Council for Scientific Research to be devoted to assessing the present status of the population. This phase, now in progress, is to be followed by the development of a management regime.

On January 1, 1971, three new national parks came into being in the peripheral woodlands of the basin, and the majority of the present black lechwe range was pronounced a Game Management Area.

Our photographic aerial surveys show the total number to be around 16,000, increasing at the calving peak of August through October. Our conclusion is that recent population estimates—especially that of 1966—have erred considerably on the low side. At present the central population appears to be stable but the peripheral herds seem to be declining still as a result of hunting.

The lechwe herds move with the flood line as it advances and retreats, so closely that they can be used as a sensitive indicator of water depth. The females and young eat the earlier growth in slightly deeper water than the males, and in consequence they migrate earlier than the males as the floods begin to recede, leaving the males to graze on the drier ground.

Stalking lechwe in the water, semiaquatic lions will drag prey to the nearest anthill to eat.

The wet season concentrations and the rut take place in the water meadows near the southern tree line. To stand among such a concentration in December, the red-gold and glossy black of 5,000 lechwe shifting against the brilliant green and sparkling water, is an unforgettable experience. The silence is intensified by the continual sibilance of distant surf stirred by the slow, seething search for food; it is broken by the sharp rattle of horns and the grunting bleat of antagonistic males as the contented wave front of a grazing herd is rippled by territorial conflicts. A receptive female is chivvied from male to male and finally subdued, the contenders lost in glittering spray as they chase and fight into deeper water.

At this time the water meadows are close-clipped to the water surface and the anthills and levees are meshed together by innumerable tracks. But in June the network unravels to the north and northwest as the lechwe follow the retreating flood line onto the collapsing grass mat. By November they have moved as much as 30 miles and are found spread out in a great straggling arc.

The first few calves of the main population are born in September, followed by a calving peak in October. No newborn calves have been seen in December, implying that all calves of the main herds were born within 12 weeks of each other. Just before giving birth, the mother leaves the herd and hides in the tall bulrushes and sedges at the edge of the swamp. Here she hollows out a bower in which the calf is born. The two remain isolated for two or three days, then rejoin the herd, the calf stepping through the water on disproportionate stilts.

We are recording the sex ratio and the percentage of calves by low-level aerial photography; but we are not yet in a position to say whether or not the survival of calves is unusually good, which would be an indication that the adults were being removed at a young age, thereby reducing competition for food. Certainly, measurements of the amount and quality of food available suggest that the numbers of lechwe could increase manyfold.

The lechwe is still being hunted by the local tribesmen—and by the heavy, dark-maned local lions, which have a reputation for large size and truculence. Al-

A small herd of tsessebe antelope sends up clouds of spray as it is pursued by the authors' airboat.

A herd of lechwe, mostly male, stands silently as the evening sun glints on birds overhead.

### *The black lechwe*

though they prey mainly on lechwe, migrating with them on the flood line, these grassland prides are not sufficiently numerous to have an important effect on lechwe numbers. Having no fear of water, they stalk and kill half submerged, then drag the carcass to an anthill to feed. When the floods bring them close to islands and settlements, they boldly parade the village paths, snuffing around the mud huts and fragile reed shelters, terrorizing the inhabitants.

There are indications that hunting may not have been the sole reason for the decline of the black lechwe. For it is well documented that in the 1930s the general water level of the Bangweulu basin rose by several feet, possibly owing to tilting of the basin floor. The waters seem not to have returned to their former level. In high flood years, this has the effect of drowning the water meadows beyond the depth at which they are most productive, and forcing the lechwe into the poorer quality peripheral grassland. In the case of the lechwe of the central swamp, they may have had no refuge from the high floods and simply perished.

Although the rise in flood levels seems to have reduced the area available to lechwe, our studies of the vegetation and of the condition of captured animals indicate that the area is still greatly understocked. We estimate that if hunting by humans could be stopped for 20 years, the lechwe population would increase to about 100,000 animals. At this level it would be possible to crop about 10,000 lechwe a year on a sustained yield basis, and use them to augment the inadequate diet of the inhabitants.

For it is clear that the environment of the floodplain is becoming increasingly deficient for its human inhabitants, who are gradually moving from the islands to the mainland, within reach of alternative food supplies and amenities. Nevertheless, the human population of the floodplain still outnumbers that of the lechwe, and is completely beyond the control of the eight Wildlife Department posts scattered throughout the floodplain.

Although the lechwe is totally protected by law, effective enforcement of this law will require a change in attitude of the people toward the lechwe and other wildlife of the area. This will need extensive public education and a radical increase in Wildlife Department effort in the area, in terms of personnel, equipment and organization.

### *The case for self-control*

Such efforts would also serve to improve the situation for almost all the area's wildlife. The black lechwe, though clearly *the* unique and important species in Bangweulu, is not the only extraordinary animal to be found there. Fifty years of persecution have driven the elephant of the surrounding plateau far out into the floodplain. Visible for miles over the grassy sea, they leave miles of pitted footprints behind them, three feet deep in the soft clay. And along with several other antelope species which include roan antelope and herds of tsessebe, is the sitatunga.

The sitatunga is a larger cousin of the bushbuck, with a shaggy plum-brown coat and white-tipped spiral horns. A semiaquatic inhabitant of the permanent swamps and marshes, it has enormously extended hooves which carry it on the deep mud and floating plants where no other animal can move. It feeds in water up to its throat on the leaves, stems and even flowers of water lilies.

Though widely distributed in Africa, the sitatunga is wary and rarely seen. But in Bangweulu, this animal is at home. Flying over the marshes, we once saw 20 (in groups up to six) in as many minutes in the tiny glades in the dense papyrus. And in the new Kasanka National Park, they tamely graze in a stream at the edge of the marsh while you sit in the open watching from as close as 50 yards away. Awed by the mystique that surrounds this elusive beast, you scarcely dare to breathe.

Two decades of self-control is a small price to pay for a chance to rehabilitate a major natural resource from near destruction to a source of life and industry and joy in natural magnificence. Can self-control recreate the world of water and anthills? And if it can do so in this little world, can the same self-control be extended to the world at large to create an environment that Man can survive in, work in and enjoy?

The sitatunga antelope is rarely seen elsewhere in Central Africa, but it is less shy at Bangweulu.

*By Peggy Thomson*

# Old-style farming suits these sisters

*Deep in the hills of West Virginia they cling to the life they have always known and combine it with a thriving weaving business*

Lynn Tusing, 68, and her sister Leora, nine years older, build their lives around land Grandfather settled.

Sisters Lynn Tusing, 68, and Leora, 77, who have more orders than they can fill for their woven wool-and-linen coverlets, live alone on the farm where their father was born atop Branch Mountain in West Virginia. As they card and spin, well warmed by wood stoves, they watch their sheep munching windfalls from the King David apple tree in their dooryard. Looking out across distant ridges they make out the landmarks of Gooseberry Rocks and the Lost River fire tower. Sighting low over the windowsill geraniums, they see the rooftop of "Topsy" in the hollow, the school they hiked to all through their youth with their five brothers and sisters, carrying baskets of rabbit hams for lunch.

A self-sufficient Mennonite pair, Lynn and Leora wear caps, no-nonsense work boots and long dresses adorned by safety pins. From behind their eyeglasses (Lynn's specked from morning milking in the barn) they present the amiable expressions of people who like their lot. The sisters are not easily vexed. They clearly like the company they keep, the food they eat—hog-meat pudding, soda cheese, sassafras-root tea, hominy made from their field corn (hybrid won't do, they say). They like their craft.

Today, Lynn and Leora hire help to plow, haul wood and spread manure. They say they are sometimes too lazy to press their cider or collect sap. These past two years they have sent their hogs out to be slaughtered instead of doing it themselves. Leora, crippled by arthritis, churns and does her share with the ax. Lynn does the heavy chores. Twice a day she feeds and milks. She works the "merry tiller," a hand cultivator, and drives the maul for chopping stovewood. She tramps the treadles of the old four-harness loom up in the sunny back bedroom where the sisters dry their beans —their speckled "birds' eggs" and round white "ballies"—in piles across the wood floor and dry their soap stacked in pyramids.

It's Lynn who hunts ("you don't need a license when you're past 65"), so that when the younger sisters visit —the ones who went away to school on earnings from the coverlets and live, married, in suburbia—they'll be welcomed with rabbit or squirrel simmered down with pork into a dark brown stew.

To friends who check on the pair by telephone, Leora generally replies, "Oh, we're able to stir around. How are you?"

On an unexceptional fall day Lynn brings Leora the first bulletins from her morning rounds. "It's windy up on the hill, stars still shining, pigs sleeping sound. I was clear back to the walnut tree before they flapped

their feeder lids. That old hen with the big spurs and the rough, nasty legs I put out in the coop. Rooster lit out when I opened the shed, didn't stop running till he reached the trees. I called to him, 'You'll be back for supper.' "

By the time the first light streaks the sky, Lynn has fed the cats in the barn and forked fresh manure onto the pile. Now she's settled into the milking which has been her job since 1918. Balanced on the one-legged stool she made for herself, right leg folded under her, left leg out straight as a pike, she milks Blackie first, then Betty, then Jersey, talking companionably into the cows' flanks ("You've got a tailful of cockleburrs, Betty") and slapping her hands as they get "sleepy." It was Jersey's mother who broke Lynn's jaw. It was "February 13, 1969. I didn't blame the cow," Lynn says now. "I believe I come in on her unexpected and she just whaled away, thinking I was the cat. When I set down to her she never flinched or moved a leg."

In the kitchen Leora does the cream separating. She stores the cream in crocks for the mailman to carry into town, sets the bucket of milk to sour on the bean-picking stool by the wood stove and scalds the previous day's clabbered milk for their cheese. The grassy-tasting evening milk goes to the animals along with the whey from the cheese-making.

The sisters share one of the King Davids ("tarty" enough for their taste but scabby-looking this year, they agree) and head out to chop wood under a sky that prompts Leora to say "it looks like the snow could fly." Lynn detours with a handout of corn for the sheep which are making a jerky progress across the yard. It takes Leora a while to get to the woodpile with a crutch on one side and the long-handled ax on the other.

*Six whacks to split oak*

Leora positions the ax-head across the top of an upended log and Lynn drives it through like a wedge, using the huge maul their father made the year Leora was born. Lynn has a fast, two-fisted, over-the-head backswing with the maul, and she splits an oak log in six whacks, her follow-through lifting her into the air with each whack.

By the time the sisters are seated at their radio listening to the 9 A.M. obituaries, Leora is satisfied that the exercise has benefited her shoulder bursitis. She expects half an hour's rocking to do the same for the arthritis in her knees, a condition she traces to the nine tomboy years before Lynn was born when she ran with her brothers and jumped repeatedly from the upper story of the barn. Leora was second oldest of the seven children; Lynn in the middle had a brother 11 years older and a sister 11 years younger.

Both sisters knit—they are making cotton bandages for lepers—as they listen to news of the deceased. "I dreamed last night the flue was crumbling," Leora speaks out, against the mortality statistics, "up in the back bedroom." Lynn, who has a weaving book open on her lap, has dropped her handwork for a close look at Federal Knot, a "real twister" she's impatient to try along with several other patterns that tempt her, like Orange Peel, Work Complete, Lee's Surrender. Old Road she thinks would suit their sister Millie. For a time Lynn lets herself rummage through the tissue paper drafts tucked between the pages. A letter containing an order she slips back into its envelope.

" 'Ora' " she says, purling evenly again, while the newscaster's voice announces services for a mother of five, grandmother of eleven, "I believe we heard this one yesterday."

Local news the sisters get from the weekly *Moore-*

*Peggy Thomson wrote about* Foxfire, *the folklore magazine, in the December 1971* SMITHSONIAN.

Swinging a freshly pulled turnip from the garden, Lynn sets off down the lane to call the cows.

*field Examiner*. They take a Harrisonburg, Virginia, daily for wider coverage. They say they don't want television and are glad the radio has a knob for turning it off. Though they voted once at the mailman's insistence, they intend never to vote again, feeling God alone knows the better candidate.

By midmorning Lynn has hauled out a grain sack of fleece and begun picking it over in her lap for her sister to card. In fact Leora first goes over Lynn's job to suit herself and only then rasps her carding boards back and forth to make the cattail rolls for spinning. Once the two have their hands into the wool, an extra-soft gray, they're reminded of the day they washed the fleece and dried it on a sheet on the grass and finished the job, flipping it over and over, by the stove. (They make their soap with Red Seal lye now, they explain, having given up their ash hopper since good soap takes green wood ashes and they burn dry wood.)

*Grandfather settled in 1866*

Presently there's a duet of the wheels—of Lynn's small flax wheel which she works seated and Leora's big one which she works hobbling back and forth. Both women like to listen to the sound. They sometimes talk as they spin, rambling over family history, from time to time verifying a date by the flyleaf of the Bible.

It was 1866 when their grandfather moved to Branch Mountain from Forestville, that being the year Uncle Levi was born. They got the Maytag washer which still dominates the kitchen in 1929 (it was gasoline-powered then). The Model T they had in the Twenties was torn down to use for cutting wood and grinding grain. The old horse, Charlie, died two years ago. Electricity must have come in the Fifties "because the minister said at Mother's funeral she lived from candlelight to electric."

The sisters tell how their father played for them on his chestnut whistle—*West Virginia Hills* and *Our Savior's Right Hand*—how he killed 22 bears in his lifetime and shot his last deer, 235 pounds hog-dressed, shortly before he died in '61. He chased it until two in the morning and that was after a day when he said he was tired from digging potatoes. They keep the antlers on the wall along with family photographs and mottos: "Do Nothing You Would Not Like To Be Doing When Jesus Comes."

They remind each other of mornings when they ate chestnuts out in the woods before the turkeys were off their roosts; of the best hiding places they ever had for hide-and-seek: Leora's in the snowdrop bush, Lynn's in the grain box (she kept a chip in her pocket to pry up the lid); of the mud and measles that closed "Topsy" so that some years their schooling amounted to six weeks. Leora remembers once trading jobs with brother Roy and then trading back ("I was afraid I'd run up on a

bear; he said housework you had to do too much over again"). Both remembered how vexed they were as they started learning to weave. Their brains wouldn't get together with their heels—until the know-how came all at once to them.

Late morning presents a dilemma. It's a good time for weaving, when the back bedroom is warmed by the sun. But Lynn likes to be out with her gun by 11 A.M., lest other hunters get all the squirrels. She makes it on time to the high field by Helmick Rocks and scans the territory, her glasses wiped clean of milk "spritz," her pocket filled with shells.

"I taught myself to shoot. I'd seen my brothers popping away, seen how they'd do it. And I bought a shotgun from Sears. I got four squirrels the first day, every one I shot at. Could have had four more but I didn't know the limit. Now I can take six a day. I got a turkey. It was the fall Roosevelt was elected the second time."

She names the mountains as she walks—"the fartherest one they call the Big Ridge, the one this side Hunting Ridge"—waving her free hand to locate the strawberry patch and the sugar camp in the hollow. "The reason I walk so fast," she says, parting the high thistles, milkweed and burrs as she leads the way down a slope her brothers used to farm, "is because my brakes don't hold so good."

Her chatter may be the reason the squirrels this time elude her. Later, when she's at her loom, she admits that talking addles her weaving somewhat, too, so that she has to stop to count out loud and consult the pins stuck in her eye-level draft. Actually, Glaring Flower, called Pine Bloom in the books, is a pattern she has down pat. It's the sisters' favorite, learned from the aunt who they say "was all the weaving school we had." The dark brown wool she's using, contrasting with the creamy white, is special as well—the last she had from a pet black sheep she bottle-fed.

*Days are too short*

Lynn's booted feet dance on the treadles. Once into the rhythm she throws her shuttle with authority and pounds her beater down hard. It's athletic work and satisfying—to see the flowers build up and to see the roll of finished lengths wound around the warp beam grow fat. The hard part is finding daylight hours to spend on it.

By dusk, Lynn is striding out again—this time up the steep lane to the knob overlooking Moorefield, wearing her faded denim jacket with the big pockets, a denim skirt wrapped around her dress to cut the wind, and a serviceable bonnet in place of her indoor head covering. She cuts herself a switch ("I can't drive cows without it or they think I've come to play") and, stopping by her garden, she pulls a turnip.

With a bucket of evening milk mixed with whey from the day's cheese, Lynn trudges off to feed the pigs.

The cows are where she expects them to be—grazing a field where openings in the rim of maples and chestnut oaks afford glimpses of rooftops far below. A wind is rising. Dark clouds are building in a sky that's gone pearly. Lynn's gaunt figure moves across the field. She is waving her switch, leaning into the wind, her heels digging into the turf at every step, calling to the cows—greetings, instructions—her words blown back. Vagrant sun rays put a glitter on her glasses, on the wet tip of her nose, and illuminate her turnip spring-green and purple against her blowing skirt.

In the kitchen again, face and hands red with cold, she cuts and salts a slice of it for her sister to taste. "The rain helped," Leora says gratefully. "It's a lot sweeter than a week ago."

Old, skilled hands thread wool on the bobbin at the spindle of the small flax wheel.

The 255-acre farm lies in a countryside little changed since Grandfather's day. His barn still stands at left.

*Opposite: Start of advertising insert*

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Gottlieb Herder: "I wanted to see blood on his forehead from his invisible crown of thorns."

*Text and drawings by Hansel Mieth*

# A girl's upbringing in old Germany

*Our ways are always changing, how drastically we cannot tell unless we cross a bridge from today back to yesterday. This is a memory, stretching from our times back to the Kaiser's Germany of World War I, when a small girl was growing up with loyalty to the people and the events, however fearful, that were shaping her.*

*Classes meant facing the anguished emotions of Gottlieb Herder, teacher and prayerful elder, who feared God and sin and even life itself*

I was seven years old, and Father had been away at the war more than a year, when Mother brought me to the schoolhouse next to the church. The cobblestone yard was filled with boys and girls of my own age, crying and forlorn. We were sorted into groups of equal size. And so I became one of 64 girls constituting Gottlieb Herder's burden.

He was middle-aged, spare and tall, his face clean shaven and arranged in long, pious lines. He had a sharp Adam's apple which sometimes, for no reason,

Little Hansel: "We did not really know what sin was. . . . We became afraid of our bodies and our minds and we watched ourselves with fearful suspicion. . . ."

leaped and danced while he sat quietly behind his desk. He always wore a smooth black coat and black stovepipe trousers, large black shoes and a wide-brimmed hat. During school hours the hat reposed on a stand, near his desk.

Gottlieb Herder lived with his spinster sister in a peasant house not far from the church where he served as an elder. After school he did the chores on his farm. But he lacked the toughness of a peasant. His hands had never become calloused; his arms were not hard bundles of muscle; his face was far from leathery. His speech was never coarse.

For the two interminable years he was my teacher I never came to know him well. He weighed his actions and thoughts by a final reckoning, and he did not wish to be found wanting—nor did any of us, lest our failure be charged against him. He transmitted to us a share of his uncertainty, his fear that to reason might lead to doubt, and to doubt meant to sin against his all-powerful God.

We feared this God and his punishments. We did not really know what sin was, nor how many sins there were, and our teacher was not too sure himself. He counted up all he could name, then said that unnumbered nameless sins resided within our bodies—sinful feelings and lustful thoughts, the devil's own temptation. We became afraid of our bodies and our minds and we began to watch ourselves with fearful suspicion —puzzled and confused.

In class Gottlieb Herder remained a monklike figure, friendly but always distant. He would pace the aisles in measured steps, hands clasped behind him. He would stand over a little girl, watching her struggle with the letters on her slate. He would stand, tall and unbending, for a long time. Then his hand would reach out to guide hers, but before he touched her it would recoil, and his face would flush and he would turn abruptly and stare at the wall, his back to us. We would watch his hands work, his nails dig into his flesh, and then his hands would unfold and go to his face and remain there. Sometimes Gottlieb Herder would sit behind his desk, his face buried in his hands. He would not be aware of us. He would not hear the small crying of frightened little girls.

He never touched us with his hands. If we brushed against him by accident he became flustered. He would lift the curls off a girl's face with a ruler and tell her gruffly to keep her hair in place, or he would point the ruler to an open collar and admonish a girl to be decent. When he felt it his duty to punish one of us with the rod, he would stand beside his desk, silent, lips pressed together, the muscles of his face working. He would stare into space until the girl before him timidly held out her hand to receive the punishment. The rod

*The author and her late husband, Otto Hagel, were distinguished photographers, mostly for* Life *and* Fortune. *They left photography and bought a farm near Santa Rosa, California, before World War II.*

My mother: "I knew that her arms yearned to hold and her hands to caress, and I knew how seldom she found the courage for affection."

would tremble. The eyes of the girl would search for his and when contact was established he would lift the rod and bring it down desperately upon the outstretched hand. The girl would bite her lip and go back to her seat. Gottlieb Herder would throw the rod upon the desk and go to the window. His arms would clasp the frame, his body would tremble and when he turned back to us to continue with the lesson, his face would be worn and white.

Gottlieb Herder came closest to us when he taught us the singing of hymns. He played his violin with his long, bony fingers, and we tried to match our voices to the tune. And before Christmas he also managed to lose his stern austerity. He taught us Christmas songs and then, holding the violin in his hands and softly plucking random notes, he told us the story of the child Jesus and of his pale, pure, virgin mother.

But then he pointed to us and called us by name and said that because of our sins Christ was nailed upon a cross to die, although it was hard for us to understand why God would let his own son be tortured and murdered. We were not really afraid of Gottlieb Herder, but we feared this God whom he tried so hard to please in school and whom he exhorted at the village's evening prayer meetings.

Because I was her eldest, my mother took me with her to the prayerhouse many times. It was in the old part of town—the peasant part. It was a stone structure surrounded by elderberry bushes and fruit trees, hidden away deep in a garden. Here, tall trees grew close together, their thick branches touching across the old steep roof.

I was half frightened of the meetings, but I liked to walk with Mother. She led me by the hand and told me about life in the village where she had been born. She told me about her father's farm, about ducks and geese in the pond and the stork wading on long legs. She told me about the wagon wheel atop the roof of the church where the storks had their nest, how the stork and his wife went away every year like the swallows, and how he returned with the same wife every year. When we passed the church, Mother pointed to the deserted wheel upon its roof and said that the fumes of the factories in our village had driven our storks away.

As we walked, dark figures would sometimes emerge from the houses along the road and join us with a pious greeting. But most of the time we walked alone, Mother and I. The road climbed steadily to a narrow alley that branched off between two leaning houses. The alley was cobblestone, and down the middle of it ran a trickle of smelly water. Mother would grasp my hand firmly to guide me. The way lay uphill between orchards and gardens surrounded by old picket fences, half hiding neat piles of stovewood and rich heaps of manure. Near the top we turned through a creaky gate and followed a path that, hedged by dense growth, led to the prayerhouse.

Here the night pressed close with the heavy smell of decaying leaves, the mycelium of fungus and sprouting mushroom growth. Ahead, the faint light from the prayerhouse filtered through stained-glass windows, daubing the underbrush with blood-tinged patterns, making every fern a tortured shape. I imagined spirits of good and evil noiselessly choking and strangling each other in the darkness.

*Stolen glances at praying figures*

The prayerhouse was like a secret room among the silent trees. Dark, smooth-worn benches faced a long table raised on a dais. Mother would guide me over the stone floor to our bench, far in the rear. Then she became lost to me as she sat with bowed head and clasped hands in deep meditation. I pretended to do the same, but all that would ever come to me was a muddle of bewildering thoughts. Head low, hands

clasped, I stole glances at the praying women, the earnest faces of the men.

My nostrils quivered with the smells of Sunday clothing, of stored apples, of onions and nuts, of cider and smoked sausage, of cellar-stored sourdough and potatoes. The peasants' strong body odors mingled with warm smells of farm animals, of fragrant hay, of steaming milk soup with caraway seeds. There also lingered the spicy smells of geranium and anise, of dill and rosemary. And everywhere lay the rich odor of dark, fat soil. The smells were so wholesome, so arousing that they had a great deal to do with my wanting to come to prayer meeting.

Back of the long table underneath a large picture of the Last Supper sat the 12 elders. Abraham Tauber, oldest, wealthiest and therefore most respected, occupied the high-backed chair in the center, his gnarled hands upon the brass-hasped Bible. On either side of him the others ranged in order of age and possession of worldly goods, in conscious echo of the picture on the wall. They wore their prayer-meeting faces along with their Sunday suits—godly faces creased, folded and ironed into shrouds of humility. Between the folds of godliness I thought I could detect shreds of the real faces, the irritated tiredness, pinching fears, eternal insecurity, hot-tempered peasant brutality. I felt that the men's souls must be as warped as their hands and their faces.

The eyes of the elders would close in silent prayer. Then one would rise to pray aloud. "Oh Lord God in Heaven, have mercy upon us," the prayers always began. The praying elder would raise clenched hands to his chest and with head thrown back burst forth in entreaty and then self-accusation. He would praise, plead and implore. He would ask God's blessing for home and crops and beg God to protect the sons fighting righteous battles on enemy soil, to guard Kaiser, King and Fatherland, to bestow guidance and wisdom upon the men chosen to lead Germany to greatness; to keep the German armies victorious so that peace might soon return.

Gottlieb Herder was called upon to pray more often than any of the others, and when he did my emotions overwhelmed me. From his first word I was held captive. I felt as if every word he spoke tore my body even as it left his lips. His body shook in anguish, perspiration stood upon his forehead, and I was unable to raise my hand to wipe the perspiration from my own. He tortured himself, tearing at his heart, at every tissue in his body—and my body ached with him.

I loved and hated him, was awed and terrified by him, was drawn to him and wanted to flee far from him. I had a mad desire to fling myself at him, to tear and scratch him. I wanted to see his pale face red with bloody tears for which he yearned. I wanted to see blood on his forehead from his invisible crown of thorns. But I recoiled from my emotions. Wanting to escape his presence, I sometimes slipped to the floor beneath the benches, pressing my face to the cooling stone, stifling cries of anguish.

*I remember my mother . . .*

On such foundations was built my education. I remember my mother, years later, stooped by illness and hard labor, her spine curved from sorrow and from prayer, on the day I left home forever. I still see her with her shoulders drawn forward, her hands hanging at her sides, voiceless in defeat. We did not dare embrace that day, but I knew that her arms yearned to hold and her hands to caress, and I knew how seldom she found the courage for affection. I felt I could not bear to leave her even while I knew that I could no longer stay.

And I still remember Gottlieb Herder trying to bring a new light into our lives, but failing to make the light shine brightly enough for us to see clearly. I came to discover that Gottlieb Herder's wrathful God had no place in the natural world that I was beginning to understand. I found myself hating what he and my mother had, between them, tried to do with my mind and spirit. They were so alike in their beliefs that they often merged in my memory as I left them far behind in the shadows.

I have lived on two levels—an upper, rational, objective level and a lower, older irrational plane where I leaned toward emotional qualities. And I have discovered that science and rationality can become more cruel than Gottlieb Herder's old God ever was. And so, at last, I have learned both to accept him and my mother again. And thereby I have made peace in my inner house.

"He taught us Christmas songs . . . holding the violin in his hands and softly plucking random notes. . . ."

"My mother became lost to me, sitting with clasped hands in deep meditation. I pretended to do the same."

*By Edward S. Ayensu*

# The religious, 'stupendous' passionflowers

*The blossoms stirred missionary imaginations; other parts have assuaged bodily pains and even were accepted in Hoover's White House*

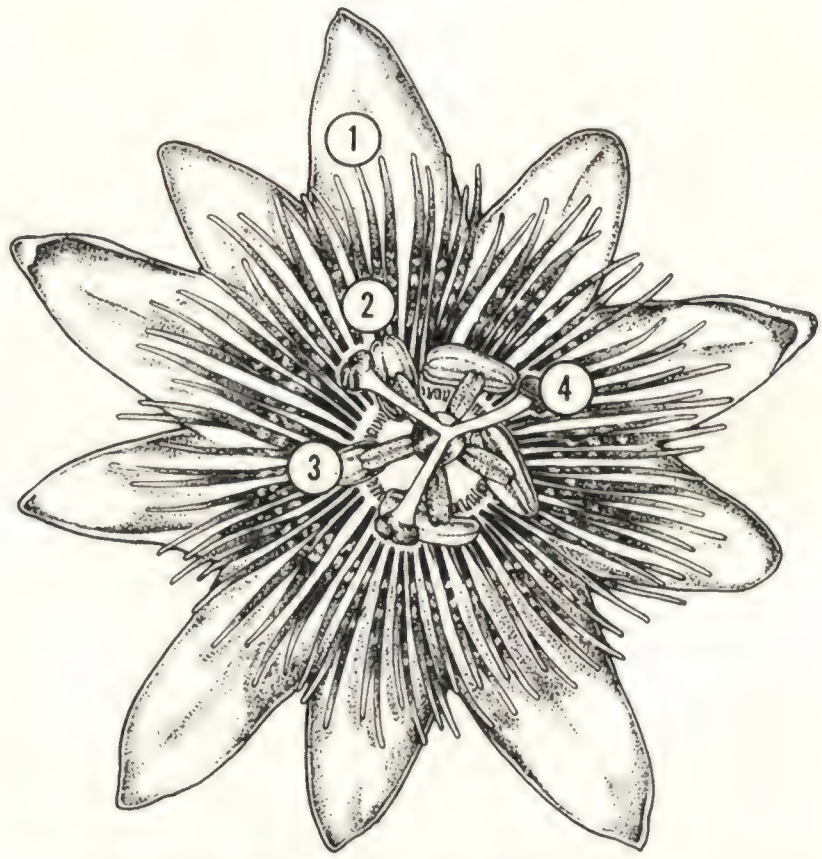
In 1610 an Italian ecclesiastic and historian named Giacomo Basio was writing a book, *Istoria della sacra Religione,* when he received drawings of a flower described as "stupendously marvelous" from a Mexican Augustinian friar, Emmanuel de Villegas. Basio was captivated by the symbolic resemblance of this flower to the Passion of Christ, but he doubted the authenticity of the drawings. Other explorers and missionaries confirmed the existence of such a flower, however, and the story goes that Basio became convinced that the flower was indeed the handmaiden of God. He felt it was his duty to present it to the entire world as an example of the Creator's works manifested in the forests of the unbelievers.

Helped along by the intense proclivity of Italian and Spanish missionaries to turn the Mexicans into Christians, the extraordinary arrangements of this plant's floral parts began to take on a host of associations, appropriate to this Lenten season, leading up to Easter. A standard interpretation went like this:

The bud of the flower represents the Eucharist; the parts of the floral envelope (the petals and sepals, see diagram) represent the Apostles of Christ, minus Peter and Judas; the corona represents the halo or the crown of thorns; the five stamens represent the hammers or wounds; the three styles represent the nails and the three bracts on the peduncle, the Trinity. In addition, the half-opened flower represents the star of the East; and the long roots descending into the earth symbolize the triumph over hell and signify Christ's rebirth.

The passionflower's significance increased greatly after it was introduced to many public and private botanical gardens in Europe. Spanish legends claim that this vine actually climbed the Cross, although the people of Jerusalem either did not observe it or could not remember it (it is not mentioned in the Bible). It was said that St. Francis of Assisi saw it in a vision. The fact that the plant finally made its way to the forests of South America was believed to be a sure sign that the Almighty wanted the Indians to become converts to Christianity.

The Jesuits had quickly seized the opportunity to proclaim that the significance of the Passion of Christ was embodied in the flower, hence its name, the passionflower (*Passiflora*). With the discovery of more species of *Passiflora,* additional interpretations became fashionable. For example, in some species there are reportedly five red spots on the corolla segments and these were referred to as the blood from the five wounds. Some species have numerous filamentous divisions to the corona and these were associated with the




In the elaborate religious symbolism of the passionflower, the petals and sepals (1) are the Apostles; the many filaments of the corona (2) are the crown of thorns; anthers (3) are five wounds; and styles (4) are the three nails. At right, at about twice its natural size, is *Passiflora coerulea.*

*Dr. Edward S. Ayensu, from Ghana in West Africa, is chairman of the department of botany of the Smithsonian's National Museum of Natural History.*

legendary 72 thorns, which, according to tradition, are said to have pierced the brow of Christ. The lower surfaces of some *Passiflora* leaves have round spots which believers claimed to represent the 30 pieces of silver for which Christ was betrayed.

Obviously, a number of Christians in Europe did not subscribe to this panoply of symbolism. A British botanist was so outraged by the statements of the Jesuits that he wrote, "I dare say God never willed His priests to instruct His people with lies: for they come from the Devill, the author of them." On the other hand, the English poet Abraham Cowley vindicated the Jesuit claims by adding yet another interpretation. The white "leaves," he said, meaning the sepals and petals, agreed with the white robes of the chaste virgins and with the choir of the Pope.

Quite apart from this extraordinary catalog of religious beliefs, the passionflower family has acquired a considerable reputation in another field—medicine. There are more than 500 species in many parts of Africa and Australia as well as in Central and South America and the warmer parts of the United States. Almost everywhere these plants occur, someone has found a use for one species or another. It may well be that many have no real therapeutic value and owe their continued use to chance and to custom, but, as often occurs in folk medicine, the medical properties of a few species have been established.

In the eastern United States, the fruit of a species known locally as maypop (*Passiflora incarnata*) is said to possess antispasmodic, sedative and narcotic qualities and the fruit juice is used as a tranquilizer for such nervous afflictions as hysteria, spasms and convulsions. Africans have made, perhaps, the widest use of the plant. In much of West Africa a species called love-in-a-mist (*Passiflora foetida,* see photograph below) is used to regulate menses, though to my knowledge no such use is made of the South American variety of the same species.

Elsewhere in Africa other genera of the plant family are widely used. East Africans cure blisters and wounds with *Adenia venenata. Adenia digitata,* called monkey

West Africans put this strain of *Passiflora foetida,* called love-in-a-mist, to medical use.

A bee pays a visit to the Brazilian variety of *Passiflora foetida* as it opens in early morning.

*Pikes Peak. The first 20,000,000 years were the easiest.*

*Seems like primordial lava, dinosaur tracks, Ute arrowheads and wagon ruts are easier to cope with than the ubiquitous candy wrapper.*

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poison, with very attractive fruits and a pleasant taste, is poisonous to cattle. The tubers are even more deadly. The leaves of *Adenia cissampeloides* are often eaten. The stem of *Adenia lobata,* known as executioner's creeper, is used in Ghana to make arrow poison, and the soluble substances in the stems and leaves of certain other adenias are used to stupefy fish. The twigs of *Androsiphonia adenostegia* are chewed in Liberia because of their anticarcinogenic properties. The bark of *Smeathmannia pubescens* is said to be effective in relieving toothaches.

A few passionflower species are grown specifically as edible fruits. *Passiflora edulis* is extensively cultivated in Australia where it attains its greatest importance as an economic plant. The same species is also grown in Hawaii, Ceylon, the Mediterranean region, New Zealand and in some South American countries, notably Brazil, for the production of frozen and canned passion fruit juice. An extract from the fruit is also used for flavoring sherbets and ice creams, and as a confection.

For many years, passionflower fruit cocktails were available in many U. S. saloons, perhaps owing their popularity to a secularized version of the plant's mythological qualities: The passionflower fruit was inevitably thought to be an aphrodisiac. Undoubtedly, it was not for such properties that passion fruit products first found acceptance in the White House during the administration of Herbert Hoover. It began in May 1929 when Ellsworth P. Killip, a specialist in American passifloras and assistant curator in the then Division of Plants of the Smithsonian Institution, received a letter from Dr. H. K. W. Kumm, an avid passionflower grower in Pacific Beach, California. Dr. Kumm wrote that he had sent three one-pound glasses of his latest experiment in passion fruit jelly under a separate cover to Killip, and Kumm said, "I wonder would you care to pass on one of these jars as a product of our latest American fruit to the people at the White House, who might like to taste it."

On May 25, 1929, Killip sent a jar by messenger to the Secretary to the President, Everett Sanders, with a letter that said, "I believe that this is the first time that the product has been made in this country." On May 28, three days later, Mr. Sanders replied, and his letter reached Killip the same day (the mail was very good in those days). "My dear Mr. Killip: The President has asked me to thank you, and through you Dr. Kumm, for his kindness in sending the jar of jelly from the passion flower fruit. It can certainly be said that this is the first gift of its kind which has been received."

In a later letter to Killip dated August 25, 1929, Dr. Kumm said, "It will interest you to know that Mrs. Hoover is ordering passion fruit and passion fruit products regularly for the White House. This must not be used in print."

There is virtually nothing prosaic or simple about the passionflower family. For example, the elaborate floral parts have a biological function besides that of stirring the imagination: They serve, among other things, to attract pollinators. I once spent nearly a full day on the island of Dominica watching passionflowers open and close. The carpenter bee (which I found later to be the main pollinator of *Passiflora edulis*) was a constant visitor from the moment the flower opened. But honeybees also came, as did moths and butterflies, while the flowers were in the process of opening. When fully opened, the flowers were visited by hummingbirds and, in the late afternoon, by large black beetles. In addition, I saw many other insects crawling slowly but steadily in and around the flowers and fruits.

There is a botanical mystery about these plants which lies in the stem. If you make serial cross sections of the stems of those species of *Passiflora* which have the climbing habit, you find an irregular distribution of the stem's vascular system. This phenomenon is called anomalous stem development and the purpose of these odd internal structures is not known. But had the explorers and missionaries who visited South America thought of slicing the stems to look at the internal structures, even more legendary and superstitious statements would have been added to the lore of passionflowers: Quite apart from the anomalous internal structures of some *Passiflora* stems, the outline of their stems in cross section resembles a bizarre form of the crucifix.

Red passionflower (*Passiflora coecinea),* native to Bolivia, is grown as an ornamental in United States.

The fruit of *Passiflora edulis,* about five inches long, is used for passion fruit juice and confections.

Morning sun highlights the yellow anthers and styles of *Passiflora longipes* in Colombia.

The handsome suit of laced armor is in the style of the Muromachi Period (1334-1572). Fierce masks were worn to terrify the enemy as well as to protect the wearer. The swords are from the Edo Period (1603-1867). The longest is signed by a famous swordsmith, Yasutsugu.

# The resplendent arms of Japan

*Weapons in the Smithsonian collections gleam anew after having been restored by an expert young craftsman from Japan*

Fujimoto, working on a raised floor, polishes the blades with a graduated set of hones to bring out the patterned texture of the steel. Note the contrast between a rusted and a restored blade.

It is disconcerting that the weapons of war, however ugly their purpose, are often remarkably beautiful in appearance. This is certainly true of the arms and armor of feudal Japan. The Smithsonian's Department of Anthropology has been collecting notable examples ever since it acquired two Japanese swords brought back by Commodore Matthew Perry's expedition, which opened Japan to the West in 1854, and it now has enough to equip a small company of men.

Since the 13th century, the art of Japanese swordsmiths has been second to none in the world, and their weapons are given esthetic ratings—and often picturesque appellations as well. A blade in the Smithsonian collections, by the 16th-century swordsmith Masatsugu, has the fierce name of "chest cutter," while another by Omi(no) Kami Hisamichi, from the 17th century, is more poetically known as "snow water."

A young Japanese craftsman, Terutoyo Fujimoto, was brought to the Smithsonian to restore some of its weapons. He appeared in traditional attire and worked on a specially built wooden platform (upper right), using methods that looked wholly traditional but were in fact a combination of old and new techniques.

In addition to the weapons (which include spears, bows and arrows, and guns) the most dramatic items in the Smithsonian's Japanese arsenal are probably the suits of armor (opposite). Some of these are so gorgeous that they were undoubtedly made for ceremonial occasions, but others, more serviceable, show the dents of actual combat.

*By Armand B. Ferrara*

# Old circus wagons are restored to glory in Baraboo

*Gaudy rolling stock, ornate with hand carving, that paraded to the Big Top every spring, still delights visitors to this Wisconsin town*

Nestled in the canoe-shaped Baraboo Valley of Wisconsin, a nostalgic vestige of circus Americana is being preserved at the Circus World Museum of the Wisconsin State Historical Society. Here, in the "dip-in-the-road" town of Baraboo, old-time circus parade wagons are still alive and rolling. In all their old splendor, they enthrall the young, who never saw a circus parade, and the old, whose memories they rekindle. Baraboo was once the winter headquarters of Ringling Bros. Circus. Why Baraboo? Because the five Ringling brothers who founded their circus in 1884 came from here.

Circus acts are centuries old and mostly European in origin. But the big-tent three-ring circus, along with gigantic circus trains, is pure Americana. Americans also took the modest street parades of European circuses and turned them into mile-long processions. There is a controversy over whether it was Nathan Howes or Aaron Turner who introduced the first cir-

Richly carved circus bandwagons ride Wild West show flatcars yearly to take part in the show, Old Milwaukee Days Parade on the Glorious Fourth. Despite its name, nearest wagon is American.

cus tent to the American scene about 1828. It was a small tent, only 50 feet in diameter, and it along with the entire circus equipment was carried on one wagon. From that small beginning, the circus grew and developed in the United States.

Beginning about 1872 with P. T. Barnum's circus on rails, the tent circus grew yearly in popularity and attendance until rising operational and labor costs and the advent of television almost killed it. In 1956 Ringling Bros. and Barnum & Bailey finally discontinued tent shows and moved instead into arenas and coliseums. When the tents were abandoned, so were many of the heavy circus wagons and the tons of other equipment needed to transport, erect and sustain a big-tent operation.

The street parade succumbed to a new age. These enormous and slow-moving marches fouled up traffic. The circuses also found that the show grounds were being pushed farther and farther to the outskirts of cities, making it too long a route for the parade to get downtown and back to the lot. Ringling Bros. and Barnum & Bailey gave up the parade in 1920. From that year on, other circuses gradually followed suit. By 1940 the street parade of circus wagons disappeared—possibly the greatest "show biz" ballyhoo medium the world has ever known.

Traveling circuses aren't really dead, of course. Ringling Bros. and Barnum & Bailey, Clyde Beatty-Cole Bros. and others still travel the big-city circuit and draw thousands of spectators. In addition, there are many smaller traveling circuses showing under canvas around the country. But the heyday of the

*Armand Ferrara, a Chicago free-lance writer, recalls seeing only one circus parade—in Indiana. "I then read all the boys' circus books," he says.*

Its ornaments now brilliantly restored, this 1903 wagon was built for Pawnee Bill's Wild West Show.

Cinderella ranks as one of the finest circus wood carvings. It was a Barnum & Bailey float in the 80s.

long-awaited circus parade and the gigantic three-ring extravaganza under the Big Top is gone, leaving behind only the carefully preserved memorabilia in places such as Baraboo's Circus World Museum.

With the fading of the traditional circus parade, ornate circus wagons—masterpieces demonstrating the skill of wheelwright, wood-carver and artist—dropped out of sight. They were often neglected, unwanted and even abandoned in fields and barns to rot and decay and finally forever disappear. Yet today at the Circus World Museum more than 100 of these irreplaceable and "almost lost" wagons have been snatched from oblivion and are adding their charm and color to the reconstructed circus grounds at Baraboo. They constitute 85 percent of all the circus parade vehicles known to exist in the world today.

The man responsible for finding and preserving them is a dapper Irishman named Charles Philip ("Chappie") Fox. In something less than 13 years, Chappie developed the Circus World Museum from one lonely building and circus wagon to today's world-famous 25-acre circus museum extravaganza. He is now working on a huge entertainment complex in central Florida planned by Ringling Bros. with a circus theme. It is scheduled to open in 1975.

The original idea for a circus museum was actually the brainchild of the late John M. Kelley, an attorney for Ringling Bros. for more than 30 years. In 1950 he began promoting the idea of a Circus Museum at Baraboo, in the very same building the Ringlings had built. He eventually talked the state into backing the project and the museum opened in 1959. Soon after, it came under the wing of the State Historical Society and in 1969 the National Park Service designated the Ringling buildings historic landmarks.

The magnificent circus wagons form one of the most exciting attractions at the museum. These have been rebuilt, repainted and restored to their former beauty and usefulness by skilled craftsmen. Circus wagon number 123, built back in 1923 as a ticket wagon for the old Ringling Bros. and Barnum & Bailey Circus, serves as headquarters from which Fox used to track down with patience and zeal long-forgotten and lost circus wagons. In summer it stands on the banks of the Baraboo River. In winter, it is moved inside a huge barnlike building, once the winter home of the Ringling Bros. elephants. The huge rings in the walls were once used to tether the animals, and the overhead beams are spiked with nails to keep restless bull ele-

Dolphin Tableau, a mirrored parade wagon, is topped off by an elegantly carved, stylized dolphin.

phants from wrapping their trunks around them and shaking the rafters.

Although deeply interested in finding and preserving all aspects of circus life, Fox's fervor was directed especially to antique circus parade wagons. The building of these specialized vehicles was a very different art from that of building the more mundane buggies and farm wagons. No two circus wagons were ever built exactly alike. They were never produced on a production line. Every wagon, whether for parade or utility, was built to specific dimensions, individualistically decorated and used for a special purpose. These parade wagons were the work of skilled craftsmen in such long-forgotten shops as the Bode Wagon Works of Cincinnati, Beggs Wagon Company of Kansas City, Sullivan and Eagle at Peru, Indiana, Sebastian Wagon Works of New York and Moeller Brothers at Baraboo.

Early parade wagons were painted with animals, Biblical scenes and even legendary griffins, serpents and gargoyles, later to be transformed into three-dimensional form by wood carving. Although early examples of this carving were rather primitive, it later developed into a definite form of folk art which gradually became as beautiful and exacting as it was different from other kinds of wood carving.

The first bandwagon made for Ringling Bros. Circus was an extended dray wagon with carvings of a crudely formed eagle on each side. An oval framed mirror made of polished tin, varnished to protect it from the weather, added interest. Henry Moeller, a wagon builder who just happened to be a cousin to the Ringlings, crudely hacked out the eagles. Later, as their circus grew and prospered, the brothers came to use the greatest artisans of the day.

Since few circus owners kept wood-carvers steadily employed in their shops, carving jobs were farmed out to specialized companies and individuals. Given the dimensions of the wagon and a sketch or idea of the subject matter, the craftsmen went to work to produce something they hoped would top their competitors working for another circus company. Each succeeding work aimed to surpass the preceding one in originality and beauty. Completed carvings were shipped to circus winter quarters, or to the wagon maker where they were skillfully fitted.

To accomplish the skilled and involved work needed to restore such wagons to "parade readiness," Fox handpicked craftsmen who, in addition to their particular skill, also had an underlying love and knowl-

edge of the circus. Top man on this team is a robust, cordial man named Marvin Gauger, who supervises all phases of the work. He and his crew face quite a challenge when a circus wagon "wreck" is brought into his shop. "It's one thing to restore a circus wagon that will only become an immobile museum piece," Gauger says. "It's quite another to restore it so it can be loaded and unloaded from a train during daily demonstrations for spectators at the museum, as well as pulled by six to eight horses in the Milwaukee parade."

The parade Gauger refers to is the Old Milwaukee Days parade, financed by Schlitz. It has been held every July 4 since 1963. It is appropriate that this revival of the traditional extravaganza circus parade should be held here, for Wisconsin was the birthplace of about 100 circuses during the heyday of the Big Top. For the parade, some of the Circus Museum's star parade wagons are loaded by Baraboo roustabouts on flatcars for the 125-mile trip to Milwaukee. Last July 4, approximately 60 museum wagons, drawn by draft horses, rumbled over the parade route in downtown Milwaukee before an estimated one million spectators.

Foremost in any of the museum's restorations is attention to detail and authenticity. Every piece of replacement wood is cut to the exact dimensions of the original. Gauger orders rough-cut lumber at least two years before it will be used so that it can be air-dried. Original ironwork is used, and if a piece is missing it is hand-forged by the blacksmith. Hand-welding would be easier, but it wouldn't meet the standard of restoration work.

Among Gauger's crew are three wood-carvers whose job is perhaps the most arduous of all—recarving intricate scrollwork and sections of human and animal figures with only a drawing or an old photograph as a guide. Since most wagons carried the same carvings on both sides, restorations of damaged features must be exact replicas of the undamaged side in size and even facial expressions.

An important step is to determine the original paint job that gave brilliance and individuality to each wagon. Color photography was unknown in the heyday of the circus, and though old black-and-white photographs are helpful in rebuilding and restoring, they are of little help to the artist endeavoring to recreate the vehicle's former beauty. In some cases original color can be discovered by painstakingly scratching through layers of old paint. In other instances, clues can be obtained from corners of a wagon that were protected from the elements.

Heavily built, iron-rimmed wheels used to slice the tarred streets along parade routes on summer days.

Swans grace a 1905 bandwagon built for Ringling Bros. Walt Disney Studios donated it to the museum.

Once the colors have been determined, the artist carefully and skillfully mixes the paints and begins the tedious but important job of color restoration. He uses every hue in the rainbow, for circus wagons were decorated with outstanding combinations of brilliant colors designed to entice parade watchers to follow the spectacle back to the circus grounds and purchase their tickets for the big show.

Generally, most wood-carved figures and scrollwork were originally covered with gold leaf. At today's prohibitive prices, this treatment is out of the question. Museum artists now make use of a gold-anodized aluminum powder.

Recent prize acquisitions of the museum's collection are 11 English circus vehicles built more than a century ago. They were found slowly disintegrating in the small village of Tiffield, about 60 miles northwest of London. They came to Fox's attention one day when a visitor to the museum recalled that while he was stationed in England during World War II, he had come across a dilapidated barn housing what looked to him like circus wagons. They were in all stages of disintegration.

"I knew this gentleman had stumbled on a possible lead for me," Fox recalled. "There was one big drawback, however. It was more than 25 years since he had seen the wagons and on top of this he couldn't recall the town where he had spotted them."

After an exchange of correspondence with circus fans in England, Fox concluded that the wagons might be at Northampton, winter headquarters of the Sir Robert Fossett Circus, one of England's oldest, founded in 1809. A search of Northampton eventually led to nearby Tiffield. Here the wagons were found.

After more correspondence with the Fossett organization, Fox flew to England to talk personally to Bailey Fossett, great-grandson of the founder. "He told me that they had stored the wagons at the outbreak of World War I," Fox said. "After that war, the wagons were never used again as the circus went to motorized vehicles. These historical wagons, somewhat smaller than our American ones, and even more intricately carved, had been in that barn for more than 50 years."

Fox recalled the day when he first saw them. "It was a dreary day and I tramped through ankle-deep mud to reach the barn. My heart sank when I saw what time, the elements and total neglect had done to those once magnificent works of art. Frankly, they looked in such bad shape that I wondered if we could ever restore them to some semblance of their original beauty and usefulness."

Surprisingly, perhaps, the owners, Mary and Bailey Fossett, agreed to give the wagons to the Baraboo museum as a gift. Crated carefully and insured for $80,000, the cargo finally arrived at the Port of Milwaukee in April 1969.

One of these wrecks turned out to be the Twin Lion Tableau, deriving its name from two golden carved wood lions on the top platform. Ingeniously, the entire top section of this wagon telescopes down into the body of the vehicle, reducing the full height from 17½ feet to only 10 feet for easier traveling. It was built about 1860 for the Lord George Sanger Circus of England and was sold to the Sir Robert Fossett show at the turn of the century.

Another find in the collection was the English Star Tableau. It featured built-up tiers like those on a wedding cake. On the topmost tier an ornate chair

Human heads and animal bodies adorn this 1879 wagon which was used by four circuses.

Magnificently carved animals and heroes' heads embellish this English wagon dating from the 1860s.

provided a high seat from which a lovely circus belle would wave to spectators.

Still another parade wagon rescued from the Tiffield barn is the Dolphin Tableau. After painstaking restoration, it turned out to be a classic example of English artistry complete with mirrors, beautiful wood-carved scrolls, faces and figures and, on the uppermost platform, a graceful carved dolphin.

Bandwagons were considered star attractions of any circus parade and were always given the honored spot in the lineup. A masterpiece of this kind at Baraboo is the Lion and Mirror Bandwagon, built in 1879. It saw service first with the Forepaugh show, where it was called St. George and the Dragon. Bought by the Ringlings for their circus and converted to its present form by their cousins, the Moeller Brothers, it was first used by them in a parade in the year 1890. Another Baraboo bandwagon with unusually graceful lines is the Swan, also built by the Moellers. It saw service with Ringling Bros., Forepaugh-Sells, Christy Bros., Ken Maynard and at Disneyland.

The giant Pawnee Bill Bandwagon was built by the Sebastian Wagon Works for Pawnee Bill's Wild West Show in 1904. Later it traveled with the Mighty Haag Circus and 101 Ranch Wild West Show. Unlike other wagons, its wood carvings depict a different scene on each side. Almost life-sized figures on one side show Pocahontas rescuing John Smith and on the other side Columbus landing in the New World.

The stately Columbia Bandwagon, built in 1902 and the first wagon to be acquired by the Circus World Museum, has a setback design peculiar to a few of the Ringling wagons. It, like many other wagons, saw service with a number of owners—first with Forepaugh-Sells, then with Barnum & Bailey, Christy Bros., and finally with Cole Bros.

Often parade wagons were built in a series. Among the most stunning of these are three fairy-tale floats, sometimes drawn by zebras, built in the 1880s for Barnum & London, the forerunner of Barnum & Bailey. Originally there were seven of these but only the three displayed at the Circus World Museum have survived. These are the Mother Goose, the Old Woman Who Lived in a Shoe, and the exquisitely carved Cinderella float (pp. 66-67).

Another series was the Cottage Cage series of the John Robinson Circus. Each of the wagons in this

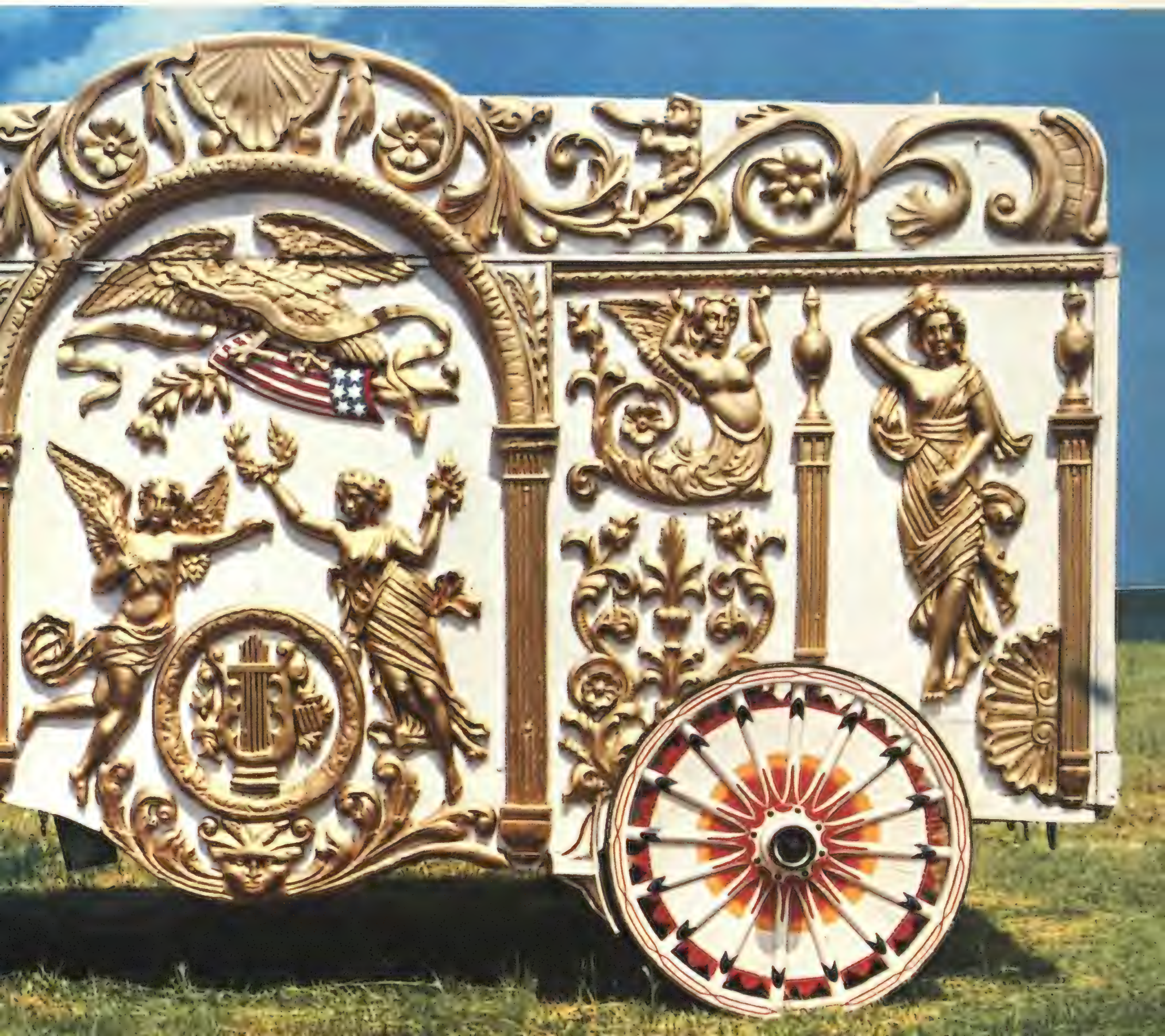
Gleaming Columbia Bandwagon was built in 1902 for Barnum & Bailey and was used until the 1950s.

group had a different design of cottage-style roof, making them quite unlike any other circus animal cages. Two of 12 beautiful cages built for Barnum & Bailey in 1883 with unusual statue corners are the only survivors of that series. They too are displayed at the Baraboo museum.

Outstanding circus tableau wagons were built in 1919 by the Bode firm for the United States Motorized Circus. Sixteen wagon bodies in all were built and mounted on trucks. Each represented a nation and included the United States, Russia, France, China and India. Most of these attractive units were lost in a fire, and today the only surviving wagon, France, can be seen at Baraboo.

A four-wagon series, featured in Barnum & Bailey's 1903 parade, was the so-called Continent series. This series depicted the people and costumes of four continents. Only portions of these units survive. Some top carvings of the Europe wagon can be viewed at the Smithsonian's Museum of History and Technology, while the Henry Ford Museum at Dearborn, Michigan, owns a portion of the Africa carvings. Both the Asia and America wagons, converted from their original form and later used by Christy Bros. and Cole Bros., are now on display at Baraboo.

Valued at more than $1.5 million, the restored circus parade wagons at Baraboo actually are priceless. They serve as a reminder of an era, long before television was dreamed of, when the circus brought joy to entertainment-hungry Americans.



The synthesizer: Sometimes used to imitate traditional strings, horns and percussion, it also makes those strange sounds we associate with space travel—the deep sound of emptiness.

*Drawings by Michael Griffin*

*By Philip Trupp*

# Synthesizers make the Now sound

*These strange electronic devices may signify a revolution in music. The sounds—eerie or imitative—crop up regularly on radio-TV*

Imagine a musical instrument that looks like a combination of Apollo space capsule console, Manhattan switchboard and science-fiction monolith. Imagine seated before this conglomerate of switches, patches and plugs a sensitive flesh-and-blood musician, head boxed in earphones, fingers outstretched on a small piano-like keyboard. Indicator lights blink. When finally he presses the keys, this incredible musical machine can approximate any sound covering the range of a symphony orchestra.

This is the synthesizer, newest and perhaps most formidable musical instrument ever invented. It is changing both the esthetic and economic profile of modern music. Awesome in its power, it has an almost unlimited ability to produce and/or reproduce musical sounds. A clarinet is first, last and always a clarinet. But a synthesizer can simulate a clarinet or anything else within the spectrum of sound.

What exactly *is* a synthesizer? Technically, it's an apparatus consisting of different electronic modules: audio-oscillators, filters and amplifiers. Its keys are simply switches, controlling the voltage to these modules. Press the keys, and pitch or volume go up or down depending on how the keyboard is patched, or hooked up, to the modules.

This electronic process overcomes the physical limitations of traditional instruments, so the synthesizer moves the musician closer to a musical freedom that the great masters never dreamed possible.

To say that the synthesizer has "caught on" as an instrument would be a vast understatement. A synthesizer was used in making the soundtrack of *Clockwork Orange* and in the scores of *Andromeda Strain* and *Catch 22*. Because the instrument creates novel and striking sounds, it is now used in some seven out of ten TV commercials. The Sears Roebuck and Montgomery Ward logos are electronic. Levi Strauss & Company uses the synthesizer to promote the sale of jeans. About half of the prime-time TV shows also employ musical electronics: *Outer Limits, Mission Impossible, Night Gallery, Ironside, Sesame Street* and many, many more.

Sometimes the instrument is used to imitate traditional strings, horns and percussion. But it also makes those strange sounds we tend to associate with space travel—modulated static, high-pitched pings and beeps, the deep sound of emptiness—a sound that is virtually bottomless. A synthesizer was used to simulate the overpowering engine sounds which were a major factor of *Grand Prix*.

The machine can make rushing sounds, clangs, whirs and spirals which soar higher and higher and seem to have no end. These strange, almost unearthly tones take our imaginations beyond terrestrial bounds and into strange worlds with soaring mountain peaks and infinite red deserts. Listening to this single outrageous orchestra, we hear the sounds of the future for which we have no apt musical description.

*Electronic music lessons for Johnny*

While it is likely that traditional instruments will always be with us in one form or another, some may pale in significance and number. In a few years when Johnny wishes to take music lessons, he'll most likely ask his parents to buy him a portable Moog, Buchla or ARP synthesizer. And not only will he study scales and rhythms, but engineering and electronics, concerning himself with sine waves and alpha patterns and the extreme subtleties of component noise.

Young people are already accustomed to the sound of the synthesizer. The instruments have been used by the Beatles, the WHO, the group Emerson, Lake and Palmer and scores of other top rock groups. Young listeners are in tune with its "vibes," its unrelenting pulse crackling with electric energy. It is the "plugged-in" sound that they have come to know in rock, have felt communally at concerts. Youthful record buyers have, in fact, already helped create an unheard of marketing spectacular, a classical recording called *Switched-on Bach,* which happens to be one of the lar-

*Philip Trupp, Washington free-lance writer and poet, is also a professional musician, competent on percussion. He is learning to play a synthesizer.*

*Synthesizer revolution*

gest and fastest selling classical records of all time. It was made on a synthesizer.

The phenomenon has filtered into schools, where electronic programs are now part of the musical curriculum. And we are not far from the fall afternoon when Home Town High's marching band appears on the field at half time not with tubas and snare drums, but with 50 portable synthesizers, each capable of hundreds, even thousands, of unique and traditional sounds. We may soon see musical parlors where customers punch out a series of sounds to create a "community symphony" on a battery of synthesizers. These parlors would be patterned after the million-dollar Island of Electronicus, off St. Petersburg, Florida, where young people gathered to participate in group concerts using six big Moog machines. Dartmouth students are also having their minds blown by an entirely new sound sensation, the "digital symphony," where a computer is plugged into a synthesizer.

The fact is that we are in the midst of a musical revolution, and evidence of it can be counted in dollars. Consider this: Companies that build synthesizers have grown; they have developed home models for less than $1,000; the Thomas Organ Company has been licensed to build small synthesizer units which attach to their home organs. At present, there is a commercial on TV for what is called the Wurlitzer Orbit III, an organ/synthesizer combo. If we stop and listen to one, we hear a melody line that sounds like an organ and a backdrop that might be inspired by one of Karlheinz Stockhausen's fanciful orchestrations for oscillators, impulse generators and five-channel tape machines. The Wurlitzer Orbit III sells for less than a good spinet piano.

Implications grow when you consider that a synthesizer can be manipulated by just about anyone. All a nonmusician needs is ingenuity, imagination and a little schizophrenia. If you own Moog's small Sonic-6, here's how you'd turn yourself into an orchestra: First, come up with a concept. What sort of sounds do you want? Suppose you decide on the sort of thing you hear in the Orbit III commercial—a melody line of single notes against a somewhat "spacey" background.

Now turn on the machine. With the tone oscillator on, you turn up the volume by spinning a dial and pressing a switch which makes the pitch waver up and down. Next you pass it through a filtering device where color and timbre are shaped, then through a voltage-controlled amplifier. The keyboard produces notes.

Experiment a bit. Find a basic rhythm pattern—something simple like a wavy oscillation. Record this on your handy tape recorder. Select other tones, other rhythms and record them too. The sounds and patterns are unlimited. Once they are all down on tape, you simply play them back while you provide a "live" musical line on top. Thus you have become an electronic composer and performer.

*Early white elephants*

Ironically, the huge success of the synthesizer has come as something of a surprise to those who first brought it to life. No one was more shocked than RCA, which first funded a study of the commercial applications back in the mid-1950s, and came up with the Mark-I Belar-Olson synthesizer. It cost several millions of dollars to produce, weighed several tons, took up as much space as 20 large refrigerators and was bedecked with miles of wiring and gadgetry. It was far too big to be handled, too expensive to be sold commercially and required an engineering wizard to play it.

Still, the Mark-I was a vast improvement over older techniques using oscilloscopes, clocks, doorbells, radios, wire recorders and electrocardiographs. RCA engineers used what is called "white noise"—ordinary radio band static, which is the total of all frequencies meshed together. They attempted to isolate each element within this amalgam of frequencies and shape its individual waves with filtering devices. This they succeeded in doing. But RCA concluded that its experiments with white noise had created for them a gangling white elephant. The project was discontinued, with the comment that "RCA sees no future for commercial application of synthesizers."

Synthesizer experiments date back to 1906, the same year that Lee De Forest invented the electronic tube. An inspired Thaddeus Cahill invented the Dynamophone (also called the Telharmonium)—a forerunner of the Hammond organ. It created wave forms from spinning metal discs, then shaped them through filtering mechanisms. The Dynamophone did not have the benefit of miniature tubes and required a series of huge dynamos for power. It weighed 200 tons. As Otto

Thereminovox: Performer waved right hand back and forth for pitch, his left up and down for volume.

It may be as significant to our comprehension of music as the A-bomb was to a new understanding of war.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Luening wryly commented in his *Unfinished History of Electronic Music*: "impractical."

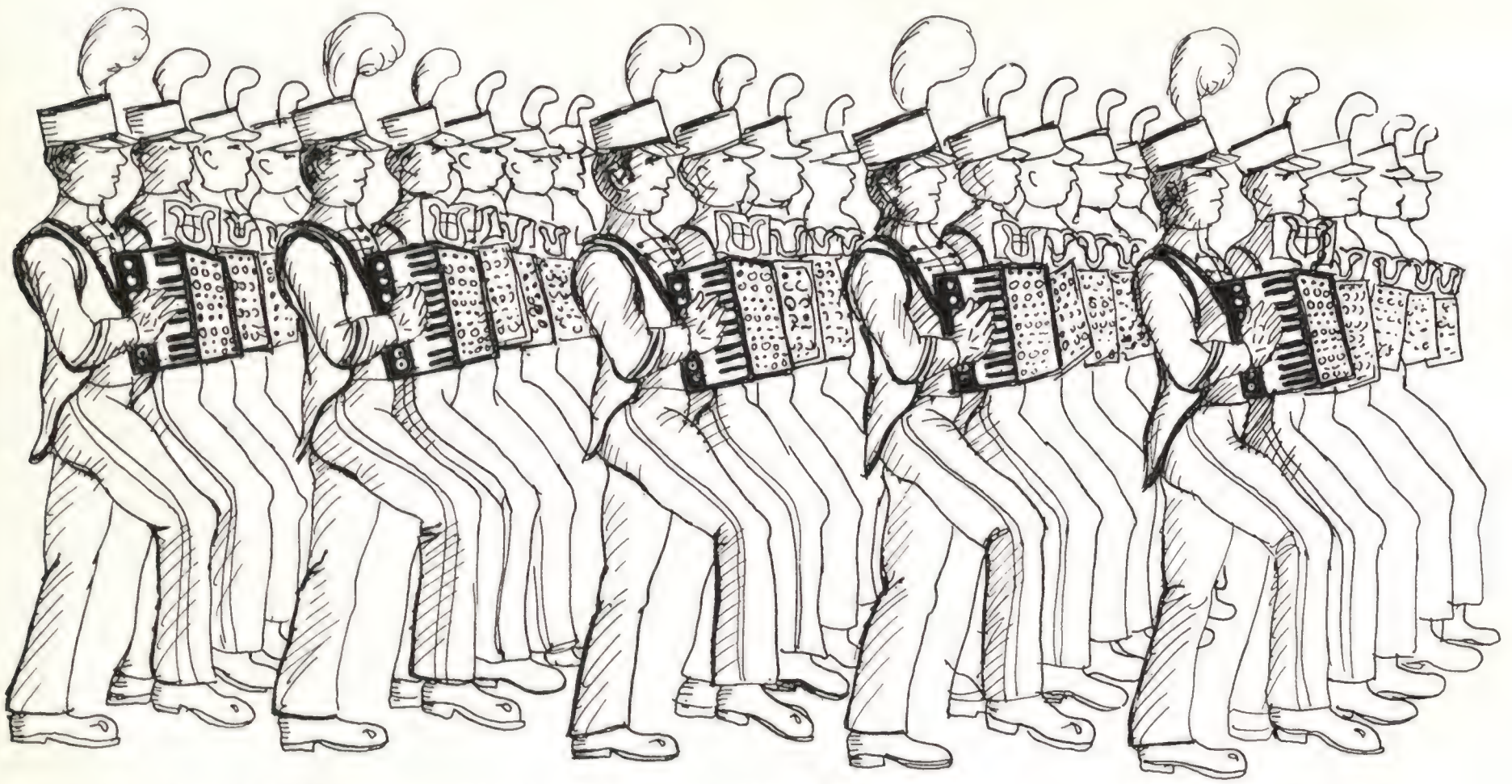
There followed a flurry of experimentation. In Italy Luigi Russolo's great "Noise Concert" featured hand-driven machines that howled and screeched. In 1916 Edgard Varèse declared that new instruments were needed to enrich the vocabulary of the modern musician, and before he died in 1965 wrote a number of compositions that showed the world what he was talking about. In 1920 the first in a series of performance-type electronic instruments was introduced by the Russian, Leon Theremin. His invention, the Thereminovox, consisted of a black box which produced a whistling sound. This sound was controlled by the performer, who stood beside the instrument's skinny antenna, waving his right hand back and forth for pitch and moving his left up and down over the box to regulate volume. It sounded a little like a musical saw.

A large family of variants followed the Thereminovox. In the late Twenties two Frenchmen, Givelet and Coupleux, found a way of combining oscillators with a control system. And in the early Thirties a group of Bauhaus students converted visible hand-drawn patterns and wave forms into audible sounds. But these systems were severely limited in the range of sounds they could make or the human emotions they could convey. This limitation was largely overcome in 1935, when the Hammond electric organ made its debut. The Hammond was a logical result of the earlier experiments and came fairly close to the original goal of pioneer electronic experimenters: a single instrument capable of reproducing the sounds of a full symphony orchestra. The Hammond created many of these sounds—some exactly, others poorly.

Yet the Hammond made it clear that the goal was attainable. Inventors continued to work on the idea of building something that could make music *without* traditional acoustic musical instruments. Among them was the late composer Percy Grainger, who, with Burnett Cross, patented in 1944 a "free music" device employing eight audio-oscillators and synchronizing equipment. These efforts eventually led to a true musical synthesizer.

Since 1955 hundreds of ingenious uses have been made of the synthesizer by the best minds in music. No longer considered a part of the "lunatic fringe," the synthesizer captivated the imaginations of contemporary composers. Milton Babbitt, Vladimir Ussachevsky, Otto Luening, Halim El-Dabh and Bulent Arel—all pioneers of electronics—each made a contribution.

The 1960s and 70s have been called the "romantic period" of electronic music. But in many ways the



We are not far from a fall afternoon when Home Town High's band appears on the field at half time not with tubas and drums but 50 portable synthesizers.

Strange, almost unearthly, tones take our imagination beyond terrestrial bounds and into strange worlds with soaring mountain peaks and infinite red deserts.

current electronic phase, with the modularized synthesizer as the dominant force, is an awesome reflection of the times. Composers have conscientiously avoided the imitation of acoustic sounds. The new music is very often impersonal, even frightening. And while many compositions are quite beautiful, they crackle with the speeded-up pace of the 20th century, emphasizing that this is a revolutionary instrument that may be as significant to our comprehension of music as the A-bomb was to our understanding of warfare.

At present, most synthesizers activated by piano-type keyboards can produce no more than two pre-programmed notes at a time. The performer must record each musical line at a time, then play them back after they have been layered and mixed together. The use of tape recorders is a must for most performers, but one young New Yorker, Bob Mason, has built a modified version of the standard ARP synthesizer which allows him to play at least ten notes at a time. Mason has combined the power of the synthesizer with the polyphonic capabilities of a piano. His group, "Stardrive," has been one of the most exciting on the pop scene.

Meanwhile ARP Instruments, Inc., has been producing a polyphonic synthesizer which is capable of producing up to four notes simultaneously on its larger models. A recent success is that of Peter Zinovieff who has devised a method simulating the individual human voice. And "PEP" (Pilot Electronic Project) in Connecticut developed the Electrocomp, a synthesizer for use in secondary schools. Thus the student can produce instantaneous "music" as he would a drawing.

Says David Van Koevering, vice president of Moog Music, Inc., "Kids want to explore the synthesizer. After all, making a sound on a trumpet is hard work. You tell a kid to apply the same energy to a synthesizer and he'll automatically broaden his whole musical base. Besides, the kids have always had *knobs* to play with, electronic gadgets to play with—record players, TV sets, and so on. They've grown up with these things, and as a result we find these kids do very well with synthesizers." Of course they must have some musical capability to start with. And Van Koevering is careful to emphasize that "the synthesizer doesn't spell doom for acoustic instruments."

What will happen to the market in a couple of years when the manufacturers come up with a relatively inexpensive, portable polyphonic instrument?

"Drastic change," replies Van Koevering. "Now we're talking about the solo orchestra performer. There is no doubt he is going to upset the market and the field of music in general." Yet, he repeats, "the great pianist will always be with us."

This large black walnut tree, shown holding up a forester, grew in Indiana's farmland and now is most likely the veneer on executive-style desks.

*By Hugh Moffett*

# Pursuing the king of the walnuts

*The black variety is beautiful, hard to find, outrageously expensive as well as impractical to cultivate—so maybe you should grow one*

I began to suspect there might be a big story hidden in the woods somewhere after casually visiting two lumberyards and two sawmills and asking how they were fixed for walnut. The reaction was such as you might imagine if a fellow walked into a jewelry shop and asked the proprietor if he could see some of his Hope diamonds.

None of these people had any walnut. Eventually I found a catalog that listed some clear, kiln-dried walnut—at a price of about $4 a board foot. I didn't need it that badly.

I began to notice items in books and journals confirming the suggestion that American black walnut has become a true treasure of the woodlands. The *National Observer* wrote of walnut thieves plundering the forests of the Midwest, stealing away with prime logs. Bold rustlers drove their truck and gear into a Des Moines, Iowa, city park and hewed down the walnuts in broad daylight.

Some rustled logs bound for export were traced to New Orleans, and identified by a sleuth who had recorded the annual rings on the raped stumps and matched them to the stolen logs. William B. Greene of Aurora, Illinois, may have noted this feat for he wrote the editor of *American Forests* magazine suggesting legislation requiring registration of logs sold with a photograph of their annual rings, which, like fingerprints, differ with each individual log.

Various writings suggested that a price of $500 for a tree with a log perfect enough to make veneer is not

unusual and that one tree has sold for $12,000. The explanation of this outrageous inflation proves quite simple. Black walnut, native to America, is a dark, beautifully grained wood. It is strong, but not so hard that it can't be easily worked. It is also stable, which means it won't warp as much as some woods. It will stand shock, which along with its beauty accounts for its desirability as rifle and shotgun stocks.

In recent years the Germans and Japanese, having discovered all this, have been importing all the best U.S. logs they can find to make veneer. The Japanese have a slicer which will cut a veneer one one-hundredth of an inch thick, so that a big log could roll out an acre of veneer, maybe more.

*A private walnut census*

While all of this is of interest to a man with a power saw and sandpaper, I might have let it all pass had I not acquired by inheritance and purchase 100 acres of land in Illinois left from a farm bought a century ago by my great-grandfather. I remembered that many years ago my father had sold some walnut trees at $50 each on the stump and I knew there were others still growing. So I went out to take a walnut census. I found several hundred walnut trees ranging from two inches in height to 60 feet, most of them small rather than large, none ready for harvest but a few perhaps a few years away from the saw. There were enough to launch me on a quest for knowledge about growing walnut which, while still incomplete, has proved absorbing and has uncovered all sorts of surprising and unsuspected activities in the U.S. woods.

The first stop was not the woods, however, but the Fine Hardwoods/American Walnut Association located in Chicago's sprawling American Furniture Mart. To reach this office, you pass through a corridor paneled with a variety of beautiful native woods and see within the office a solid walnut gout stool standing there as a whimsical plug for the product. The office manager is named (hang on now) Mary Nutter.

Mrs. Nutter explained that the association exists to encourage furniture builders to keep on making fine furniture of solid hardwood and veneer—especially walnut—and furthermore to encourage production and conservation of the wood.

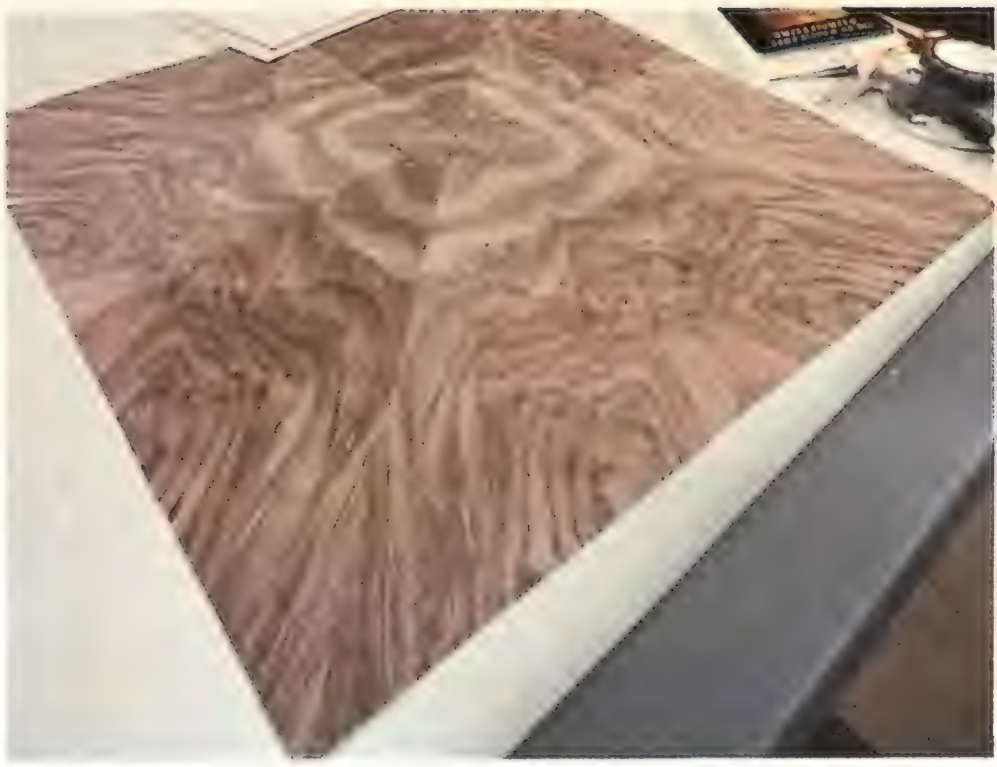
"The problem is," she said, "there are some quite good wood imitations, plastics and photographed grain designs which can be sold much cheaper than the real thing. But you must remember, the day you get your plastic piece it will look the best it is ever going to look. When you get a piece of fine walnut, every day you keep it it will look better and better."

The most important thing I picked up in Chicago is that the hope of keeping the walnut supply near the demand does not lie primarily with commercial walnut growers. Even at the high price of the wood and considering that commercial growers also make a little money on the nut harvest, it is seldom feasible to make walnut a main crop and the main source of income, since it takes from 30 to 50 years to grow a good log. The supply will likely be provided by people like me, and perhaps you, who have a few acres, or know a friend who has, who will go to the bother to set out a few trees more or less as a hobby.

The association has crammed a fat course in walnut culture into a 16-page pamphlet entitled "Growing Walnut for Profit and Pleasure," certainly the greatest dime's worth since ten cents bought two subway rides. It indicates that anyone who can grow tomatoes can grow walnut.

Like tomatoes, walnut comes from the seed, which is that black nut that is so hard to crack without smashing your thumb. You can plant the nuts, or you can buy plants from a nursery. You are better off if you live in the corn belt, as the soil that grows fine corn

North Carolina furniture-makers examine sections of log known as flitches, and admire the useful grainy areas called "the fancy faces" (see next page).



Swirling grain of black walnut "fancy faces" produces the elaborate pattern of this tabletop.

also grows fine walnut. Although black walnut is native to most of the United States east of the Missouri River, it is found mainly in the six Central states: Iowa, Missouri, Illinois, Indiana, Ohio, Kentucky.

Like a tomato plant, the walnut plant needs hoe cultivation around it. There are sprays and mulches which also will see to it that your tree gets above the surrounding vegetation. In two or three years you can forget the hoe and let your tree head for the sky. The sky is what it needs most and perhaps gets least unless helped by a friendly gardener. Whether you have to fell a mighty oak or burn the barn, your walnut tree will ultimately need an area approximately 26 to 30 feet in diameter and it is better if you allow for that possibility when you set it out. And keep it away from the fence. Buyers shrink from a fence-row log, knowing embedded barbed wire will rip up the band saw.

Your other main chore will be to prune some lower branches as the years roll by. In a dense forest lower branches are pruned naturally by lack of sunlight. Since your tree has space, you will want to cut off lower branches when they get an inch thick until you have a clear log 17 feet high if possible. But don't cut off branches for more than half of the total height of the tree. Then relax until it's time to call the sawyer. You don't have to be a lumberjack. At these prices, walnut buyers send their own woodsmen so the log won't be damaged.

I can vouch for one page of the pamphlet. It says to collect seed nuts in the fall and bury them for the winter two-feet deep in the ground, with alternate layers of walnuts put in sand or sawdust. In the fall I shouldered a barracks bag of nuts in Illinois and checked them through with me on the airplane to Vermont. Since I had neither sand nor sawdust, I buried the unhulled nuts deep in the cold, cold ground for the winter, found them in the spring and threw them in a tub of water as the pamphlet said. Two floated, indicating the nutmeat was inadequate, and I threw them away. The rest went into the garden in holes punched by a sharp stick—two inches deep. Of 48 planted, 40 sprang from the ground and most were three feet high by August.

With the vast knowledge gained from the 16 pages, I returned to the Illinois farm with a new critical eye and found violations of the walnut-growing rules on every hand. It appeared that little trees were taking several years just to beat their way through matted grass and were a few inches high instead of three feet. Squirrels plant many nut trees and their sense of geometry and tree culture is obviously amiss. Many trees were struggling along a few feet apart while not far away great chunks of open blue sky yawned unoccupied. Since no pruning saw or knife has ever penetrated these virgin lands, most of the young trees looked like porcupines rather than the graceful swan.

The greatest tragedy however was the denial of sky caused by encroachment of competing brush and trees. One 20-foot walnut seeking a way out of a thicket had bent itself into the shape of a rainbow. Others had twisted trunks formed as the tree's crown zigged and zagged to find the sunlight. Vines climbed many a trunk, living like a tiresome relative upon the sunlight needed by the walnut. Someone many years ago had left a huge coil of woven fence wire rusting away, and a walnut, protected from livestock and weeds, grew up through the wire, prospering but embedding wire strands as it enlarged.

But a few grew tall and straight, examples of what

An executive's dream: black walnut veneered desk. This wood also makes excellent rifle stocks.

a fair chance means. With pruning shears and bow saw, I spent a few days whacking away, until pronounced blisters took over.

You hear rumors here and there that nothing will grow near a black walnut tree, which my blisters proved to be inaccurate. It's probably true, however, that black walnut trees will shorten the lives of nearby red pines and maybe even white pines. Some herbs and grasses do poorly around a black walnut, but several trees, such as ash, oak and maple, thrive in nature side by side with black walnut trees. You should not, however, plant a black walnut in your apple orchard or use its leaves or bark for mulch. Furthermore, potatoes, tomatoes and alfalfa will grow ill when in contact with the root system of a black walnut, though why anyone would plant tomatoes under any tree is beyond me. The culprit is a substance called juglone, which is found throughout the black walnut plant.

During my visit to the American Walnut Association in Chicago, executive director Donald H. Gott had suggested I go to the fountainhead of all walnut knowledge and culture, the Forestry Sciences Laboratory, a research unit of the North Central Forest Experiment Station, maintained by the U.S. Department of Agriculture in Carbondale, Illinois. And so eventually I made my way to the laboratory, which sits amid walnut and other trees on the campus of Southern Illinois University. There I was taken in hand by Dr. John E. Krajicek, associate silviculturist, and Dr. Calvin F. Bey, plant geneticist.

Obviously, the first thing to clear up was "what is a silviculturist anyway?" Krajicek (pronounced "cry-check") said that most people were familiar with the word "horticulturist," one who grows and bestows affection on fruit trees, vegetables and flowers. A silviculturist, he said, does likewise for trees in general. He is in charge of taking available trees and growing them the best he can. However, Bey, the plant geneticist, explained that he is in charge of finding, breeding and producing better trees.

He reached over to a shelf and grasped a wafer of a tree trunk an inch thick and perhaps eight inches in diameter. By the markings of the annual rings you could see that for its life of half a dozen years it had grown an inch a year, a startling performance. This was a hybrid, Bey explained, a cross between *Juglans sieboldiana,* if you are now ready for the Latin, and *Juglans cinerea.* He also produced a huge black nut which he identified as the fruit of *Juglans olanchana* from far away Central America, a tropical tree which would never survive an Illinois winter. It will, however, grow in the greenhouse, and Bey has great designs on the sex life of this monster nut, hoping to cross it with a hardy northern species and thereby get a happy hybrid.

From the foregoing, you can see that if you want to get a walnut tree, you don't just go and say, "give me a walnut!" There are walnuts and walnuts.

There are some 15 species in the genus *Juglans* and the name originated with what we commonly call the English walnut, technically called the Circassian walnut or *Juglans regia.* It originated in Turkey and other Black Sea areas. A British forester named Herbert Edlin in his book *What Wood is That?* gets carried away thus:

"The Romans discovered this remarkable tree on their conquering expeditions to the East, and called it *jovis glans,* meaning 'the nut of the great god Jove [or Jupiter]'. From this we get the scientific name *Juglans.* The specific name *regia,* added by the Swedish botanist Linnaeus, means 'fit for a king'. Both are apt names for a tree that yields a deliciously flavored and nutritious nut, as well as a remarkably strong and attractive timber."

*Don't employ local nuts*

To name a few of the others, be it known that *J. cinerea* is commonly known as the butternut. There is a smallish tree in Texas called *J. rupestris,* and another on the West Coast called *J. californica.* The Southwest has a *J. hindsii.*

The king of them all, however, is the good old Yankee *Juglans nigra,* the black walnut, and that is what we set out to see in the experimental fields near Carbondale. As we rolled through the wooded hills of southern Illinois, Bey and Krajicek dropped gems of

forestry. If you want to grow walnuts you can plant the local nuts or, better, get some nuts from many miles south of you, but not more than 150 miles. The plants will "flush" earlier, which means start to grow. But if you go beyond 150, the plants may flush too soon and get nipped by the frost.

We stopped in a nursery by a plot of seedlings being sprayed with water by an overhead pipe and growing their level best. Bey, the geneticist, reached down to dig up a seedling and the split nut from which it came. By splitting the germinated nut before planting, he said, identical twin trees can be produced so that you can use one as a control tree and do all sorts of things to the other and measure the good or evil which results.

As we moved on to a three-year-old plot, Krajicek, the silviculturist, took over, showing with pride one tree which had reached 11 feet in height, about four feet above the others of the patch. This seed had come from Tennessee.

Scientists acquire wizardry. Bey explained that a tree does not grow like people, it extends. That is, if you have a crotch three feet high on a sapling, it will be three feet high on the tree grown old. He showed me a young sapling which had developed a crotch. The two limbs were pulled together and taped, with each holding the other in a vertical position. When they have grown accustomed to this position, the weaker branch will be severed at the crotch and the other is supposed to climb happily upward to the heavens, going straight all the way.

Eventually we drove east—to the banks of Crab Orchard Lake in "Bloody Williamson," a county made famous between the world wars by the gang wars of the Sheltons and the Birgers and other forms of civil strife. There we saw a plot of trees set out 32 years ago and then long neglected—its foresters interrupted perhaps by World War II. Seven years ago the present forestry outpost went to work on it. They "released" the trees, as they call it, which means cutting away any other foliage above or too close to the crown. For their efforts they can now say that some of the trees grew one-fifth of an inch every year for 25 years, and half an inch a year since release. Or put another way, more wood has been produced in the last seven than during the first 25 years.

The foresters are modest in their claims for miracle trees. Since a tree must grow for six years or more before it bears any nuts, producing hybrids and improved strains is a slow business. But that is not the real problem. It is, to be blunt, getting people to plant walnut trees or, for that matter, any trees at all. The country up to now has mostly been one of pioneers bent on clearing the land. Until recently few people have bothered to cultivate trees.

The foresters and nurserymen are crying the gospel. Commercial producers of crops can't wait the 30 to 50 years to pay the taxes and make a living. So it may be left to the hobbyists, the city cousins of farmers and a few of us dilettantes to preserve the wood fit for a god. Since many of us will be long dead before a nut makes a mighty walnut log, we must consider it something for posterity, a gesture to wash away our sins—well, maybe a few of them.

The author, shown opposite guarding his mighty trees from black walnut rustlers, was photographed by his son Mark in Brandon, Vermont, to which he retired after a career at *Life,* where he was an assistant managing editor. Above is a Moffett walnut fantasy.

# Do You Make THESE Travel Mistakes?

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- ☐ What's the riskiest thing you can do in booking a Caribbean yacht charter?
- ☐ What's the most expensive mistake most travelers make in Hong Kong?
- ☐ Why should you be careful about shipping things back from Africa?
- ☐ What 10 things should you be absolutely sure to check before renting a villa abroad?
- ☐ If an airline cancels your flight and tries to put you on one several hours later, what's the first thing you should do?
- ☐ What cardinal rule do most knowledgeable travelers observe when ordering bottled water abroad?
- ☐ Why do experienced travelers check their credit cards after returning from abroad?
- ☐ What basic rule do experienced travelers observe before checking in their luggage on a flight?
- ☐ What common mistake do many travelers fall into in February and March?
- ☐ In flying from the U. S. to Australia, what's the worst mistake you can make?

## Not mistakes — *but do you know . . .*

**What's currently the most exciting archeological dig in the Greek Islands? Why does your travel agent so often send you to that big chain hotel when what you really wanted was that "charming little inn"? What are the fashionable thoroughbred race tracks in Paris? What are 15 of the world's big game fishing spots? Where are Denmark's most attractive country inns? How do you go about arranging a golf game at a Japanese club? Is a trip up the Rhine really worth it?**

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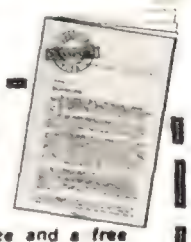

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# *Book reviews*

*Faces of the Wilderness*
Harvey Broome
(Mountain Press Publishing, $7.95)

Harvey Broome was a man of the wilderness, for all seasons and all weather. As president of The Wilderness Society, an organization he helped found in 1935, he was an able, inspiring spokesman for a movement that is now penetrating the conscience of America.

On my first hike with him in the Great Smoky Mountains, we ventured to the Chimney Tops, a steep climb, almost vertical for several hundred feet, hand over hand from one rocky perch to the next. It was raining and I dared to complain. Harvey answered with a laugh. "You don't complain about weather in the Smokies. You just learn to accept it!"

In *Faces of the Wilderness,* Harvey reveals himself exactly as I knew and loved him: a gentle spirit, sensitive to the needs of nature and his fellowman, always with tolerance and good humor. Such individuals are rare, and so are such intimate and appealing books as this one. The reader shares discomforts, discoveries and exhilarations of wilderness travel in various sections of the country, on seashores, in deserts and high in the mountains from Alaska to the Everglades; and, when he puts the book down, he feels (as Justice William O. Douglas comments in the foreword) that he has been in the good company of a man who honored the earth for its mystery and beauty.

Most chapters represent personal accounts of field trips taken by the Council of The Wilderness Society in conjunction with its annual meetings, starting with

the first in 1946 up through 1965. Broome died in 1968.

His book is no preachment, but the lesson to be derived from it is plain: Man must live in reasonable harmony with nature or perish from this Earth.

On the western slope of the Olympic Peninsula in Washington, Harvey walked through the beautiful Bogachiel and Hoh watersheds, preserved in their pure, natural state as a part of Olympic National Park, and then into logged-over areas administered by the Forest Service. The latter were "places of grayness, dead limbs, dead boles, washings, and of torn, lifeless soil. . . . The waste was appalling." As Harvey recorded the scene: "Gray log butts eight feet in diameter, twenty-four feet long, cracked in the sun. They had been left to disintegrate presumably because they had an unsightly or inconvenient knot. This waste of wood was spiritually devastating. Men had sought to convert the green life and repose of the forest we were in, to the dead grayness of the forest we had left, because of the 'shortage' of lumber. Why had they not used up what they had abandoned? Some of the stumps were twelve and fifteen feet above the ground."

He saw deficiencies as well in our national parks. "The atmosphere was holidayish but there was no wilderness," he wrote of the scene around Old Faithful in Yellowstone. "People swarmed from their cars to see the buffalo, as though they were starved for the sight of something old and natural and primordial. And yet, so far have we moved from that past, several nearly grown boys referred to the bison as a deer."

Perhaps the solution lies in extensive preservation and wise use of wilderness as part of the national life-style. People need to learn, starting in their tender years, love and reverence for nature, and through nature, for one another. This is Harvey Broome's "optimum goal for all mankind"—a message of hope.

*—Michael Frome*
Conservation editor of *Field & Stream*
and author of *The Forest Service*

*White Silence*
Sylvia E. Crane
(University of Miami Press, $9.95)

Sylvia Crane has prepared a useful biographical study of America's first genera-


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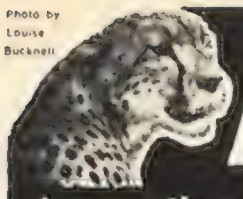

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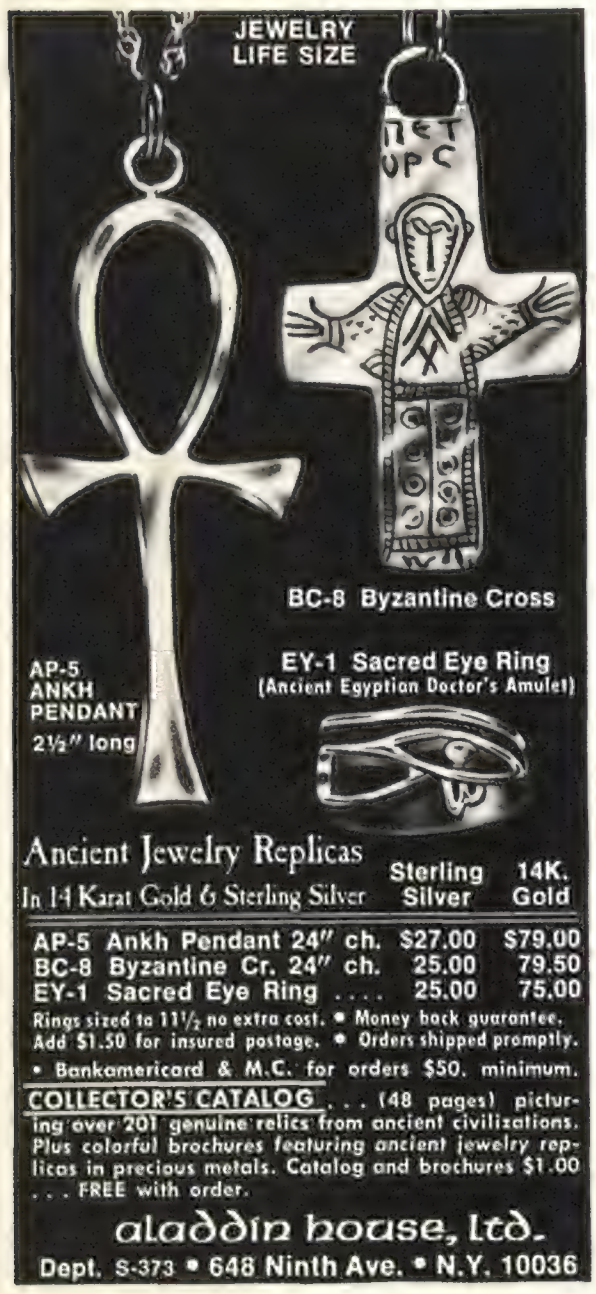


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tion of expatriate sculptors—Horatio Greenough (1805-1852), Hiram Powers (1805-1873) and Thomas Crawford (1813-1857). The author has made extensive use of various manuscript collections and has inserted throughout the text numerous quotations which greatly enhance her readable survey. Accompanied by more than 50 excellent photographs and thorough notes, *White Silence* can and should be consulted by the scholar as well as the interested layman.

Worcester Art Museum

*Boy Playing Marbles* by Thomas Crawford

The Smithsonian Institution is particularly fortunate to have a splendid collection of works by all three of these artists. Greenough's marvelous half-naked portrait of George Washington, clad in a toga and sandals, and remarkably un-American in his Zeuslike appearance, is now displayed in the Museum of History and Technology. This massive, nearly 11-foot-high marble was previously housed in the Smithsonian "castle," a building that Greenough derided, referring to its turrets and belfry as "merely ornaments like the tassels to a university cap." While the reviewer was somewhat disappointed in the author's unwillingness to embark on a much-needed reappraisal of this controversial masterwork in American sculptural history, her discussion is clear and factually correct.

In treating the life and career of Greenough, the educated Bostonian who did most of his work in Italy, Mrs. Crane describes the importance of the portrait bust as a readily available source of income for the young sculptor. She also makes a good analysis of the intense con-

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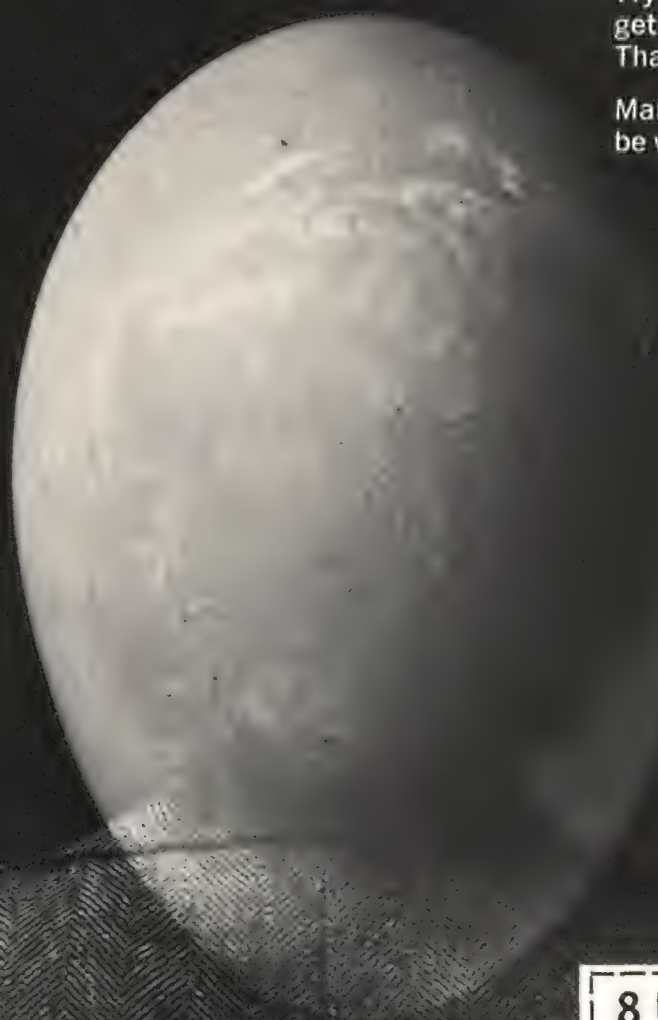

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flict between Greenough's esthetics of functionalism and his own style, derived from the neoclassical Italian school.

Housed at the National Collection of Fine Arts are the sculpture and other effects from Hiram Powers' Florence studio (SMITHSONIAN, November 1972). Mrs. Crane's discussion of Powers' early career as a portraitist is important and her assessment that Powers was "at the top rung of American sculptors" is correct. Her biography of this expatriate who never returned to America is particularly enlightening in the passages that reveal Powers' cantankerous and pragmatical personality.

Thomas Crawford, who preceded Powers to Italy by two years, chose to settle in Rome rather than Florence. This intensely prolific sculptor was drawn toward the prestige of the public commission. His achievements in the *Washington Equestrian* in Richmond and the *Progress of American Civilization* pediment for the Capitol are considerably innovative. He also designed the figure of a helmeted woman, *Armed Liberty,* for the top of the Capitol dome. Again it is ironic to note that the original plaster model for this emblematic figure belongs to the Smithsonian, in light of Crawford's caustic remark that the Institution's "castle" looked like "a gigantic round of overcooked beef that has been well hacked with a dull carving knife."

Mrs. Crane's book is a good supplement to the earlier biographies of Crawford and Greenough by Robert Lee Gale and Nathalia Wright, respectively. She has integrated the neoclassical triumvirate's art and biography with finesse. The reviewer must warn the reader, however, that the checklist is often erroneous. For example, Greenough's first idealized statue, *Chanting Cherubs,* was never in the possession of the National Collection of Fine Arts, as listed by the author.

*White Silence* is then a guarded accomplishment, falling short of the definitive book which must still be written on the three sculptors who chose to work in the established security of Italy while producing statues and monuments for America.

*—Michael Richman*

Assistant to the Director of the National Portrait Gallery


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Peggy Wayburn
(Sierra Club Landform Book, $14.95)

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Although the book presents general descriptions of estuaries, it focuses on the Bolinas estuary just north of San Francisco. Chapters are presented on green plants, aquatic organisms, birds, relationships of man to estuaries and the history of Bolinas Lagoon. The chapters start with personal experiences in semipoetic prose but quickly dive into scientifically accurate, semitechnical descriptions and factual data. An exception to the scientifically accurate information presented is the debatable teleological interpretation that organisms develop special attributes because they need them.

Interesting estuarine invertebrates are described, but are not illustrated. Fish, despite their extreme importance in estuaries, are dismissed in three terse paragraphs. This book is more about the birds —which are fully discussed and illustrated in excellent style. The past relationships


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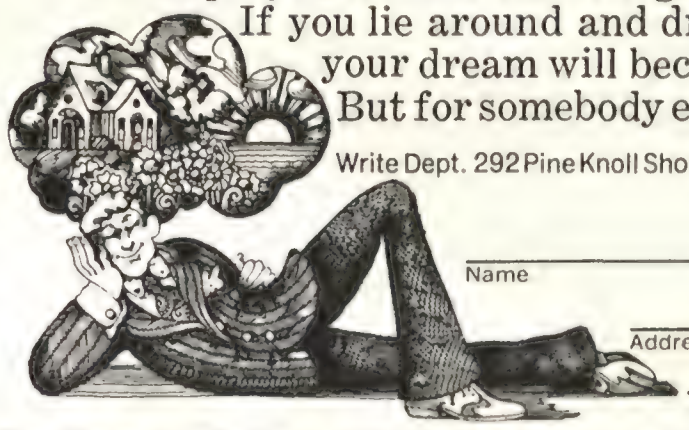

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of man to estuaries are fascinating and well presented. Even the origin of life, perhaps in estuarine areas, and evolutionary development are clearly and interestingly discussed.

There are many large, full-color photographs by Dennis Stock; however, they are mostly bird pictures and plant scenes, especially silhouettes with interesting lighting. These are not identified and some do not relate to estuaries. It is disappointing that there are no pictures of the highly photogenic and interesting aquatic estuarine organisms, except for one shot of snails on wood. The printing is in "elegant" (wasteful) style on glossy paper with half-page margins. There is a nine-page "quickie ecology course," called "Notes on Ecology," plus a bibliography on brown paper at the end of the book which will be helpful to many people.

This readable book will fill a need for educating the public on estuaries, their inhabitants, their problems and the necessity to preserve them immediately.

*—Dale W. Jenkins*
Director, Ecology Program
Smithsonian Institution

*Richelieu*
Louis Auchincloss
(Viking Press, $16.95)

The redoubtable Red Eminence, who in the 17th century started feudal France on its way to becoming a nation, has intrigued many a novelist and biographer. Alexandre Dumas, in his novels, showed us a sinister egomaniac, while other writers portrayed a benevolent old soul who hid his twinkles behind an austere facade; even today, at least ten English-language biographies are currently in print. So when a novelist *and* biographer of the stature of Louis Auchincloss, sensitive to the uses of power at the top, comes out with an opulent new book on Richelieu, you reach for it expecting new insight into that complicated character. You won't find it.

Auchincloss shows us only a humorless, competent but pedestrian intelligence never wavering from its purpose. "There is not a political idea or institution that comes to us from Richelieu," the author maintains. "He was an administrator, pure and simple." I just don't believe it.

Richelieu's purpose was to wrest power


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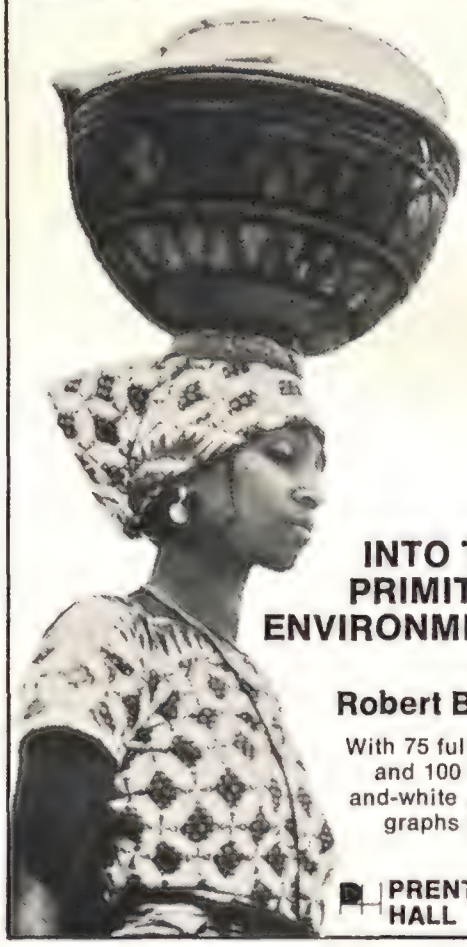

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from the French nobles (who squandered it in internecine warfare) and concentrate it in the hands of his stubborn, ineffectual, homosexual monarch, Louis XIII. In short, Richelieu was a nationalist. But Louis, far more closely akin by blood and ideology to the other royal houses of Europe than to his own subjects, and lazy to boot, had to be delicately manipulated every step of the way. Surely the man who managed that without destroying the necessary illusion of the king's omnipotence was more than "an administrator, pure and simple."

Nor was that my only disappointment. Despite its magnificent cover, large size, lavish illustrations and high price, the book shows a great many evidences of hasty production, both textually and visually. The writing is not up to Auchincloss' standard. One gets the feeling that he grew bored with the work.

It may seem ungrateful to complain about the illustrations—which are beautifully reproduced on fine paper—but I do. There are some 158 of them (not including many outsized and elaborate printer's ornaments), but I had to count them to find out as there is no list of plates, nor are they indexed. Also, if I were an absolute monarch, my first decree would be that all books dealing with history include maps. There is one in this book, but it is very cleverly hidden. It isn't mentioned in the table of contents or index, but I'll give you a clue—look at the very back *behind* the index, of all places.

*Richelieu* is not really a bad book—it's just that it could and should have been so much better.

—*Pat Tucker*
Washington free-lance writer

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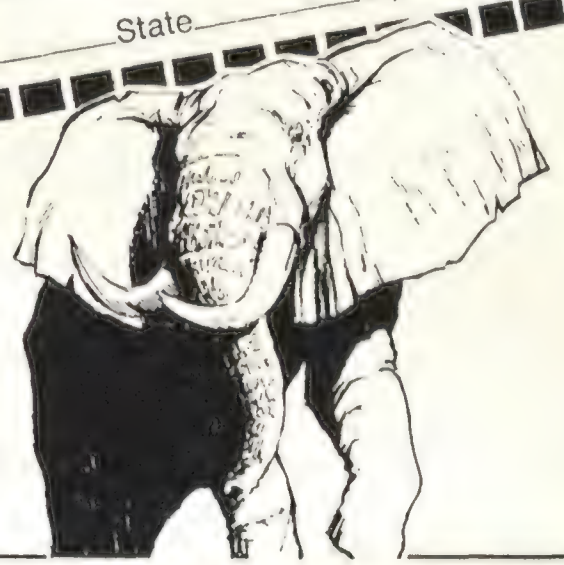

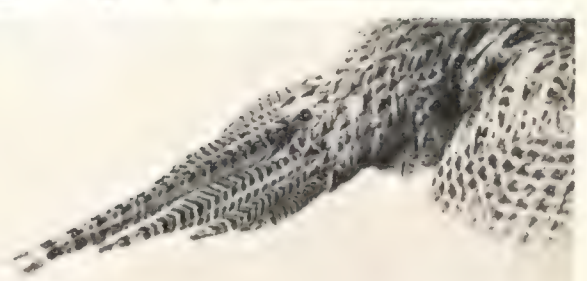

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# *Smithsonian highlights*

*Division of Performing Arts*
For ticket information on the following presentations, call (202) 381-5395.

"American Indian Theatre Ensemble," the first all-Indian theater company in America, appears in Baird Auditorium, Museum of Natural History, 8:30 P.M., March 3, 4 and 5.

"Saeko Ichinohe and Company," contemporary Japanese dancers, sponsored in cooperation with the Japan-America Society, perform original works in Baird Auditorium, Museum of Natural History, 8:30 P.M., March 10.

The series of Jazz Heritage Concerts concludes with the Sonny Rollins Jazz Quartet, Baird Auditorium, Museum of Natural History, 8 P.M., March 11.

"Jim Hall and Tiny Grimes" are featured in the last event in the American Guitar Series. The concert is at 8 P.M., March 24, Baird Auditorium, Museum of Natural History.

"Skazki" continues at the puppet theater, Arts and Industries Building. Performances are at 10:30 and 11:30 A.M., Wednesday through Friday, and at 10:30 A.M., 12:30 and 2:30 P.M. Saturday and Sunday. "Skazki" closes April 8.

*Freer Gallery of Art*
"Illustrations of the 'Tales of Ise' by Sotatsu and Korin," an illustrated lecture in the series on Oriental art, by Professor Miyeko Murase of Columbia University, will be presented in the Gallery Auditorium on March 13 at 8:30 P.M.

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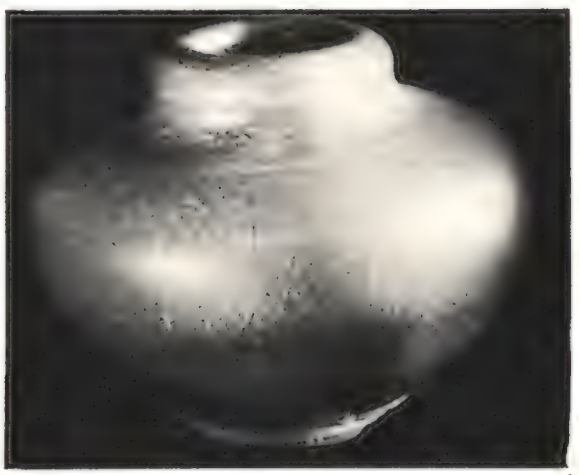

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**Museum Reference Service**
The Smithsonian Associates have inaugurated a new service known as the Smithsonian Associates' Museum Reference Service. Members traveling within the United States may write for a folder comprised of lists by states of many of our country's museums, galleries and historical sites. Brochures are included when available. Specify the states in which you will be traveling and subjects of interest. Allow three weeks for mailing. Write: Smithsonian Associates' Museum Reference Service, Associates' Reception Center, Smithsonian Institution Building, Washington, D.C. 20560.

*Musical Weekend in Washington*
The Friends of Music at the Smithsonian and the Division of Musical Instruments announce their second weekend of music, May 4-6. The tour includes concerts and receptions at the Smithsonian and other Washington cultural centers. For information write: Mrs. Lois Howard, Museum of History and Technology, Room 4125, Smithsonian Institution, Washington, D.C. 20560.

*Arts and Industries Building*
"Beyond Jupiter" includes approximately 20 new astronomical paintings by Chesley Bonestell.

"Exhibition Flying" is represented by the barnstorming Waco 9 of the Golden Age of Aviation (1920-1939); the Turner RT-14, designed exclusively for racing; and the Pitts Special, the type of plane used recently in the FAI World Aerobatic Championships.

**Smithsonian Speakers**
The National Speakers Bureau, a new service of the Smithsonian Associates, provides an opportunity for organizations within the United States to request curators and other Smithsonian staff members to lecture on a wide spectrum of disciplines. Travel and other expenses are paid by participating organization. Write: National Speakers Bureau, Smithsonian Associates, Smithsonian Institution, SI 118, Washington, D.C. 20560.

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# Tours for Associates

Study tours are designed as educational travel for members of the Smithsonian Associates. Smithsonian staff or other experts accompany all tours. For information, see below.

**Foreign Study Tours**
For information: Miss Bliss Schumann, Room 123 SI, Smithsonian Institution, Washington, D.C. 20560.

*Cave Paintings:* A tour of prehistoric caves and related museum exhibits in Spain and France—April 2-24.

*Baroque Tour:* Baroque architecture in Germany, Austria and Switzerland, plus medieval tours and visits to private and public art collections—May 11-June 2.

*Russian Museum Tour:* Moscow, Leningrad, Samarkand, Tashkent and Siberia are the places visited in this three-week tour of Russia's cultural institutions—May 31-June 22.

*African Safari:* Tanzania and Kenya game parks, plus the Seychelles in the Indian Ocean—July 17-August 7 (waiting list only).

*Mexico and Guatemala:* A visit to historical sites of Yucatán, Oaxaca, Mexico City, Tikal and Antigua (depart from and return to Miami)—August 27-September 14.

*Aerospace Museums:* A nontechnical tour of these special museums in Munich, Lucerne, Moscow and London—September 17-October 3.

**Domestic Study Tours**
For information: Mrs. Patricia Kilkenny, Room 106 SI, Smithsonian Institution, Washington, D.C. 20560.

*Big Bend National Park:* Exploration of southwest Texas, from the desert, canyons and mountains of Big Bend National Park to a trip across the Rio Grande River—March 11-17.

*Family Weekend:* View an exhibit in the making; tour a restored gristmill; take a highlight tour of Washington, D.C.; choose from field trips that include the National Zoological Park and the Chesapeake Bay Center for Environmental Studies—April 13-15.

*Folkcraft and Musical-Instrument Makers:* Talk to and watch traditional craftsmen, musical-instrument makers, weavers, potters and others at work in Kentucky, North Carolina and Virginia—April 23-29.

*Skin Diving on the Santa Maria Site:* Skin dive at the site if you desire and explore the beauties of Cap-Haïtien, Port-au-Prince, the Citadelle and Tortuga Island—May 13-23.

*Vanishing Indian Crafts:* Southwestern tribes demonstrate their ancestral crafts and how they are keeping them alive—the weeks of May 11, 18 and 25.

*Olympic National Park:* Visit Washington's alpine meadows, mountains, lakes and rain forests; take side trip to Victoria, British Columbia—June 24-July 1.

*Alaska Float Trip:* Starting at Anchorage, join in a six-day float trip down the Copper River, followed by an extended cruise through Prince William Sound—July 18-August 1.

*California Colonial History:* Explore the architecture and history of Hispanic California from Los Angeles to San Francisco—September 22-29.

*Acadia National Park, Maine:* Experience the craggy shores and rugged cliffs of New England's national park—September.

*Sea and Shore Laboratory, Charlotte Harbor, Florida:* Using the facilities of Mote Marine Lab, participate in ongoing research problems concerning birds and shallow-water animals—October 11-18.

*Renwick Gallery*
"Contemporary Paintings by East Indians," sponsored by the Embassy of India, is a look at that country's modern art scene; March 16 to April 15.

"Objects for Preparing Food" displays more than 500 utensils, containers and other objects—handcrafted and manufactured, antique and contemporary—that show various processes for the storing, preparation and cooking of food throughout the world.

In conjunction with the "Objects for Preparing Food" exhibit, free lecture-demonstrations on unique cooking styles and techniques are scheduled at 1 P.M. and 8 P.M. in the Grand Salon of the Renwick on the following days: March 9, Barbara Frielander, author of *Earth Water Fire Air;* March 16, James Beard, author of *American Cookery;* March 23, Joyce Chen, author of *Joyce Chen's Cookbook;* March 30, Dinah Ayensu, author of *The Art of West African Cooking.*

*National Collection of Fine Arts*
"The Eighth National Dulin Print and Drawing Competition" features 65 works that illustrate the breadth of American draftsmanship and printing. Opens March 23.

"Alfred H. Maurer (1868-1932)" looks retrospectively at an American artist who worked mainly in the figurative tradition but used techniques of the Fauves and Post-Impressionists.

*Smithsonian Associates*
"On Museum Objects, Truth, and Education—Reflections of the Secretary of the Smithsonian Institution upon the 125th Anniversary of its Founding," by S. Dillon Ripley, is available free of charge to Smithsonian Associates. Write: Smithsonian Associates' Reception Center, Great Hall, Smithsonian Institution, Washington, D.C. 20560.

*Museum of History and Technology*
"If We're So Good Why Aren't We Better?" is an encounter with America's pursuit of productivity. The exhibit surveys the history of productivity from the colonial "work-ethic" culture to today's efficiency expert; better-life rewards and problems of waste, unemployment and pollution are illuminated.

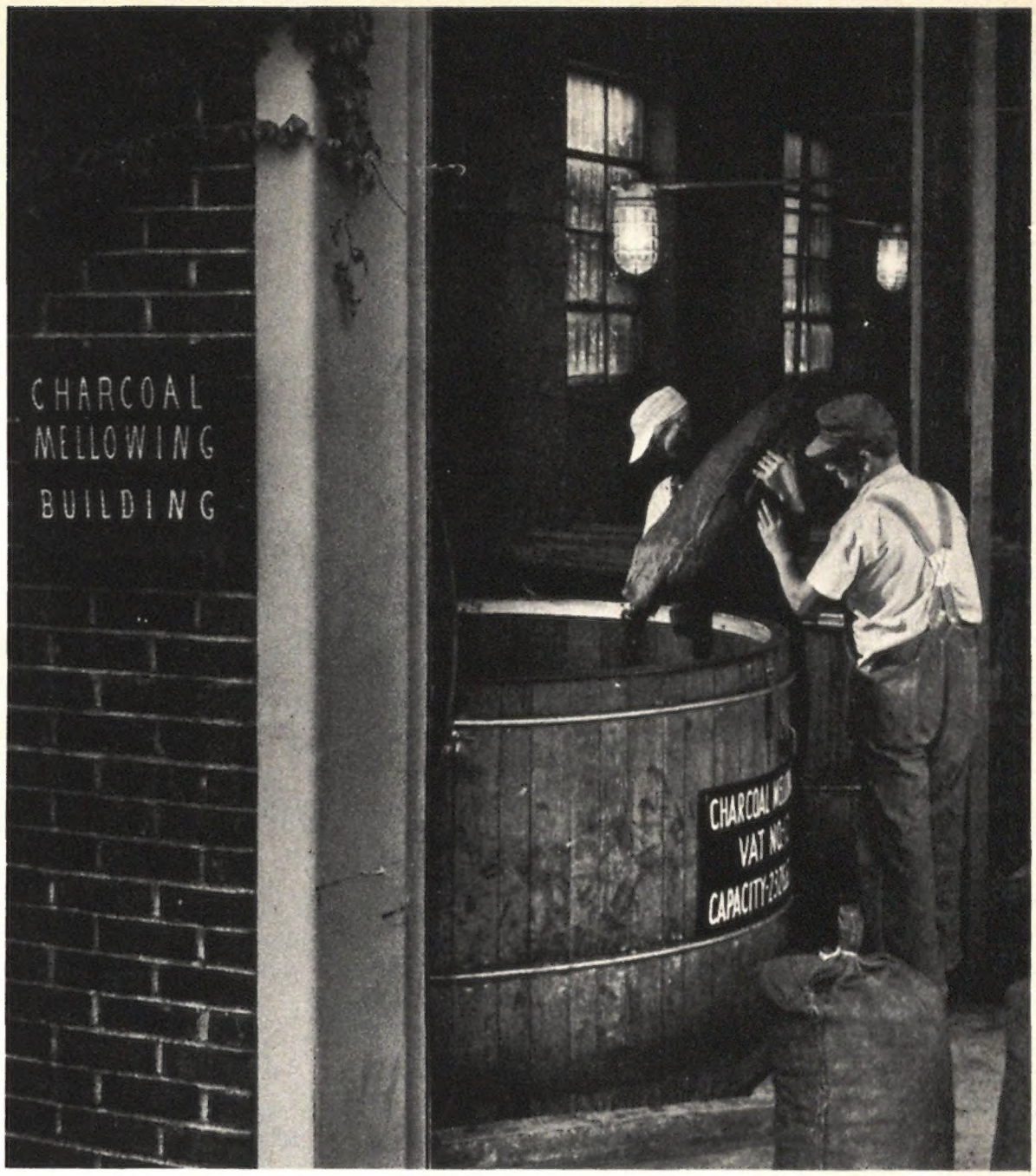
*National Portrait Gallery*
"The Lazzaroni" features 20 portraits, along with letters, documents and equipment of the small group of intelligentsia —mostly scientists—that dominated the American scientific community in the mid-19th century.

*Traveling Exhibition Service*
There are up to 70 different Smithsonian-sponsored exhibitions on display each month throughout the United States and Canada. For a complete listing and information on how to bring an exhibit to your area, write: Traveling Exhibition Service, Smithsonian Institution, Washington, D.C. 20560.

- Daytona Beach, Fla.—"The American Artist and Water Reclamation" (Museum of Arts & Sciences, Mar. 17-Apr. 15).
- Cambridge, Mass.—"The Laing-Stories: Dismantling a Landmark" (Harvard University, Mar. 10-Apr. 8).
- Crawfordsville, Ind.—"Alexey Brodovitch and His Influence" (Wabash College, Mar. 17-Apr. 15).
- Palatine, Ill.—"The Genteel Female" (William Harper College, Mar. 3-Apr. 1).
- Raleigh, N.C.—"A Children's World (III)" N.C. State, University of N.C., Mar. 10-Apr. 8).
- Midland, Tex.—"Indian Images (II)" (Museum of the Southwest, Mar. 10-Apr. 8).
- Athens, W. Va.—"Paleolithic Cave Paintings of France and Spain" (Concord College, Mar. 17-Apr. 15).
- San Diego, Calif.—"Meteorological Optics" (San Diego Hall of Science, Mar. 10-Apr. 8).

*Smithsonian Commons*
Luncheon facilities for members of the Smithsonian Associates are in the original Smithsonian Building. Open Monday through Friday from 11:30 A.M. to 2 P.M., the Commons offers a buffet luncheon from $1.40 to $1.85 upon presentation of an Associate membership card.

*Parking on the Mall*
Metro construction has made parking on the Mall near the Smithsonian complex extremely difficult. The use of fringe parking areas and/or public transportation is recommended. Current parking information may be obtained by writing to the Smithsonian Associates' Reception Center prior to your visit.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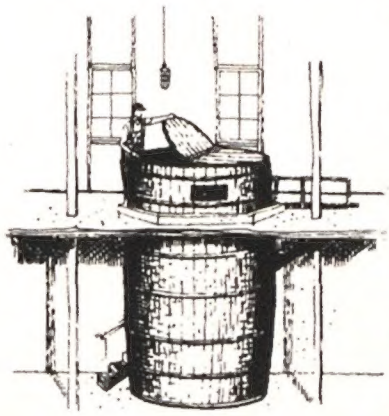

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*By Patrick Ryan*

# *Then let them eat nightingales' tongues*

Bad news comes simultaneously to the man in the Moscow street and the gourmandizing millionaire in Miami, as the fell hand of pollution strikes equally at communist and capitalist. The Soviet caviar output has lately been running so low that it is now hard to find in the shops of the people and is mainly reserved for sale in the special emporiums for foreigners where alien currency is the medium of exchange.

The shortage of sturgeon has been attributed in part to the continuing shrinkage of the level of the Caspian Sea by about six feet during the last ten years. Its surrounding inhabitants, moreover, apparently wish to insure that it becomes another Lake Erie. Power stations and chemical factories along the lower Volga add increasing effluents to the Caspian's diminishing waters. The oil rigs of Baku contribute generous emissions of dark sludge. And Astrakhan, the caviar center, pours in some 30 million gallons of variegated sewage per day.

So the pickled roe of the family *Acipenser* are no longer available as a staple delicacy of Soviet bourgeoisie and are also in such short supply that Western plutocrats have scant prospect in the next decade of savoring them in restaurants at less than eight dollars an ounce.

Russian scientists have taken sturgeon-preserving steps which they claim will halt the decline of our costliest hors d'oeuvre. Antipollution plants have been installed along the industrial Volga, inland sturgeon breeding farms have been set up, successful hatching has been fostered by injecting the young sturgeon with pituitary extracts, and fish ladders have been built around power station dams to help the adults up to their spawning grounds.

And, although ideological differences may prevent the Kremlin from acknowledging her assistance, the Queen of England has also done her royal bit to help the Russians with their problem. In recent legislation about wildlife, Queen Elizabeth generously gave up her ancient and royal right to claim any sturgeon caught within her realm. This should discourage immigration to British waters of any social-climbing Caspian residents dissatisfied with the communist way of life. It should also insure an occasional second helping of genuine Best Beluga at Buckingham Palace banquets.

To those born poor and unfortunately honest, the eventual attainment of such fabled delicacies of the rich is often an anticlimax. Disappointment attends many palates when champagne turns out not to be heavenly nectar but just white wine with bubbles. And caviar can provide similar disillusion for the tastebuds: After all, the gray-black globules are simply fishy, salty and thirst making. So they seemed, at any rate, when provided as a regular item of diet to British soldiers in the Crimean War. The Tommies complained to their officers that "We've 'ad enuff of this 'ere black fish jam."

Today, when you have to pay in wads of folding money for a spoonful of the fancy seafood, there is also the financial worry that you may not, in fact, be getting the real Caspian McCoy. While red "caviar" is not strictly so, coming from salmon eggs, the various ova of cod, catfish, whiting, shad and mullet may also be processed and dyed shiny black to pass as the genuine *Acipenser* tidbits of the Czars. Connoisseurs can detect the difference, but the casual caviar consumer cannot eat enough of the real stuff to develop an expert palate without going so broke that all he can afford is baked beans on toast.

Still greater dangers of duplicity may threaten banqueters from another branch of Soviet science. Some time ago, Russian researchers into the production of artificial foods announced that they had succeeded in making a synthetic and gourmet-baffling version of caviar from petrochemicals. If these imitation fish eggs are ever marketed, opulent eaters are going to have the additional problem of working out whether their glistening thimbleload of high living came from the bosom of a virgin sturgeon or the borehole of a Baku oil well.

But all is not over for the Lucullan celebrant. Though there may be shortages of caviar, truffles—maybe even nightingales' tongues—it is reported that there is still an ample supply of well-stacked young ladies willing to leap naked and giggling out of giant birthday cakes at the last note of "For He's a Jolly Good Fellow!"

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